Practical Computing

60p

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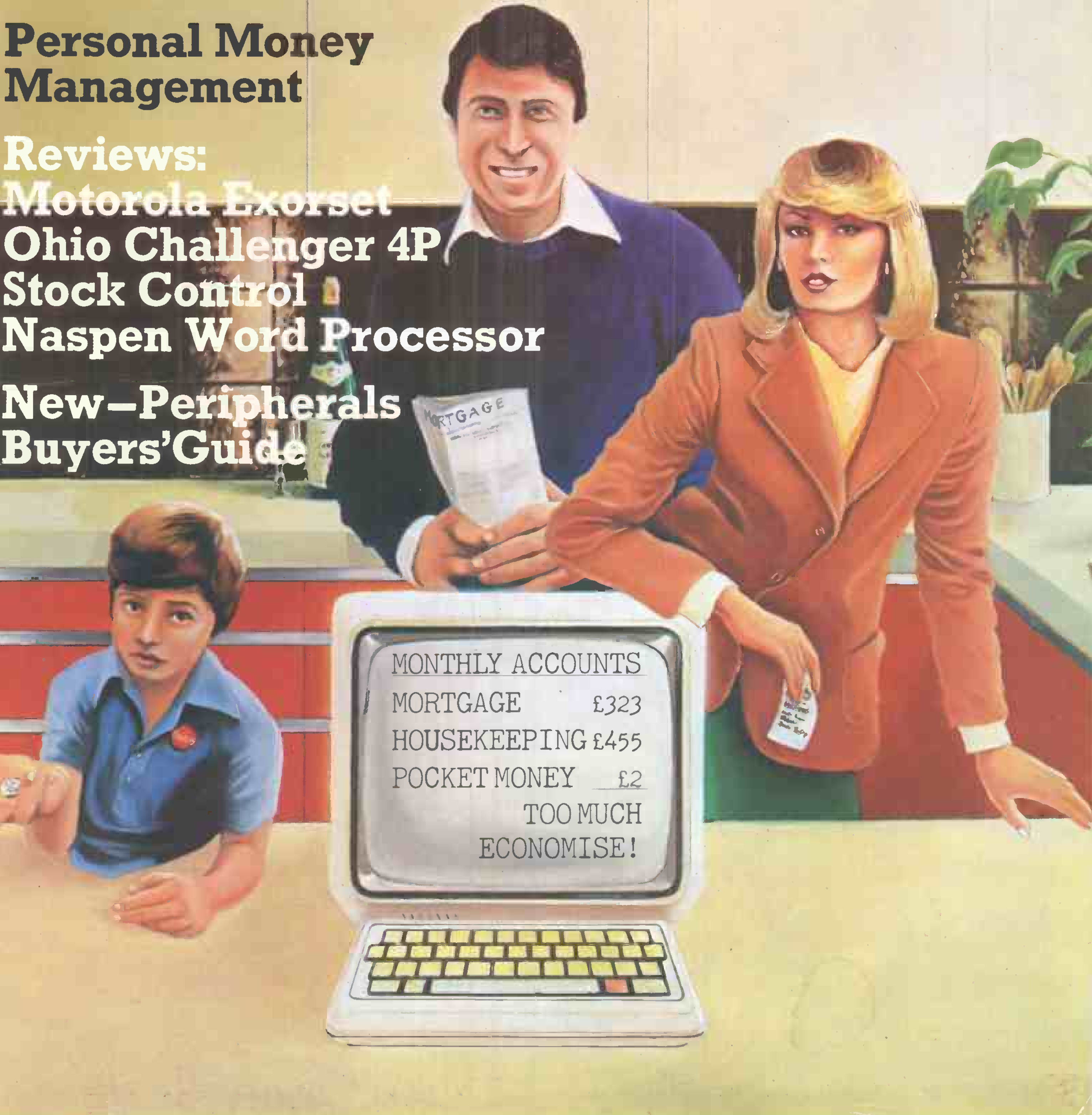
Volume 3 Issue 9

Personal Money Management

Reviews:
Motorola Exorset
Ohio Challenger 4P
Stock Control
Naspen Word Processor

New—Peripherals Buyers'Guide



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● **Circle No. 101**

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CONTENTS

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SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard SuperBrain features include: two double density mini-floppies with 350K bytes of disk storage, 32K of ram memory (expandable to 64K) to handle even the most sophisticated programs, a CP/M Disk Operating System with a high powered text editor, assembler, debugger and a disk formator. And, with SuperBrain's S-100 bus adaptor, you can add all the programming power you will ever need...almost any type of S-100 compatible bus accessory.

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application... General Ledger, Accounts Receivable, Payroll, Investory or Word Processing, SuperBrain is tops in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disk storage and a full 64K of RAM. All standard!

Whatever model you choose, you'll appreciate the careful attention given to every engineering detail. A full ASCII keyboard with numeric pad and user-programmable function keys. A non-glare, specially focused, 12-inch CRT for sharp images everywhere on the screen. Twin Z-80 microprocessors to insure efficient data transfer to auxiliary peripheral devicess. Dual universal RS-232 communications ports for serial data transmission. And, a single board design to make servicing a snap!

Your operators will appreciate SuperBrain's good looks and you'll appreciate SuperBrain's outstanding value. Because as your processing neds become more sophisticated, you can add auxiliary hard disk storage...up to 96 megabytes.

Truly incredible performance. All in a single, smart looking, self-contained desktop unit. And, all for a price that's substantially less than the competition.

COMPUSTAR™

MULTI-USER TERMINAL SYSTEM

At last, there's a multi-user microcomputer system designed and built the way it ought to be. No more ugly, bulky boxes and those endless miles and miles of entangled cabling. With the CompuStar, there is only one box - the unit itself. Complete with screen, keyboard, dual drive system and multi-user connectors. And what a beautiful addition it makes to any environment. The sleek, desk-top enclosure houses all the computer power you'll ever need and allows for the convenient connection of up to 15 additional users, a printer, a modem and a hard-disk drive system - all via a single, user-accessible rear panel. Now that's truly amazing, isn't it?

But the real beauty of the CompuStar is its "shared logic" design concept. Each user station contains its own distinct microprocessor and RAM. The result is lightning fast program execution. Even when all 16 users are on-line. Even when all are performing different tasks! A special multiplexor circuit in the CompuStar ties all external users together to "share" the system's disk resources so that no single user ever need wait on another. An incredibly exciting concept!

A remarkable breakthrough in price/performance, the CompuStar boasts nearly 1 megabyte of online mini-disk storage (almost 2 megabytes on CompuStar II) and can be easily expanded to 20, 36 or 96 megabytes of hard-disk in just seconds. And since each user station can accommodate up to 64K of RAM, a total of over one million bytes can be incorporated into the system to tackle even your most difficult programming tasks.

CompuStar user stations can be configured in a countless number of ways. A series of three intelligent-type terminals are offered. Each is a perfect cosmetic and electrical match to the system. The CompuStar 10 - a 32K programmable RAM-based terminal (expandable to 64K) is just right if your requirement is a data entry or inquiry/response application. And, if your terminal needs are more sophisticated, select either our CompuStar 20 or CompuStar 40 as user stations. Both units offer dual kisk storage in addition to the disk system in the CompuStar. The Model 20 features 32K of RAM (expandable to 64K) and 350K of disk storage. The Model 40 comes equipped with 64K of RAM and over 700K of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of obsolence or incompatability is completely eliminated since user stations can be configured in any fashion you like whenever you want - at amazingly low cost!

Software costs are low, too. CompuStar's Disk Operating System is the industry standard CP/M. And, an impressive array of application software is readily available to run on this system. Some powerful programming languages are available, too. Basic, Fortran and Cobol. As well as several specialised communication packages. All in all, the CompuStar handles just about all of your data processing needs at only a fraction of the cost of comparable systems.

DISK STORAGE

Options for the Superbrain and Compustar Video Terminal
Three Specially-Designed Models

Now there's a sound and simple solution to your disk storage needs. Intertec has devised three "small" solutions to what used to be a big problem for intelligent terminal and microcomputer users. How did we do it? Easy.

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Each drive is shipped equipped with an EIA standard 19" rack mounting system and heavy duty chassis slide mechanisms to permit easy accessability for fast and efficient servicing.

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+ + COMPLETE SEARCH / CREATE / AMEND / DELETE / SORT / FACILITIES ON ANY SIGNIFICANT LEDGER HEADING AGAINST EITHER OPEN OR GENERAL LEDGER IN DATE / INVOICE / ACCOUNT / AGENT / NOMINAL CODE / HEADINGS, FOR FULL INFORMATION RETRIEVAL SUCH AS A SHORTLIST OF OVERDUE ACCOUNT FOR A SPECIFIED MONTH, ACCOUNT LEDGER CARD RETRIEVAL, NOMINAL ANALYSIS ETC.
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☐ (L) **PAYROLL** – Designed in conjunction with the spec for PAYE routines by HMI Taxes. Processes up to 250 employees on weekly or monthly basis. Can handle cash, cheque or bank transfer payments plus total tracking of all year to date figures. Prints emp master, payroll log, payslips and bank giros. Requires CBASIC-2 .... £475/£15

☐ (L) **COMPANY SALES** – Performs sales accounting function. Controls payments of invoices and prints sales ledger and aged debtors report. Suitable for any accounting period. Comprehensive VAT control and analysis of all sales invoices. Requires CBASIC-2 .... £425/£15

☐ (L) **COMPANY PURCHASES** – Performs purchase accounting function. Controls invoices, credit & debit notes. Prints purchase ledger, aged creditors report and payment advices. Comprehensive VAT control and analysis of all purchases. Interfaces with the ADD system. Requires CBASIC-2 .... £425/£15

☐ (L) **GENERAL ACCOUNTING** – Produces Nominal Ledger, Trial Balance, P/L and Balance Sheet. Define your own coding system. Interactive data entry plus optional data capture from Company Sales and Company Purchases. Requires CBASIC-2 .... £375/£15

☐ (L) **STOCK CONTROL**
Maintains stock records, monitors stock levels to ensure optimum stock holding. Details include stock desc., product code, unit, unit price, quantity on hand on order/minimum. Stock analysis reports can be weekly, monthly, quarterly etc. Interfaces with Order Entry Invoicing system. Requires CBASIC-2 .... £325/£15

☐ (L) **ORDER ENTRY & INVOICING**
Performs order entry and invoicing function. Handles invoices for services and consumable items, part orders and part quantities. Sales Analysis report shows sales movemets and trends for user-defined period Interfaces with Stock Control, ADD and Company Sales systems. Requires CBASIC-2 .... £325/£15

☐ (L) **ADD** – Complete control of all your names & addresses including suppliers, clients, enquiries etc. Assign your own coding system and select all output via the report generator. Will print anything from mailing labels to directories. Requires CBASIC-2 .... £225/£12

☐ (L) **COMPLETE ACCOUNTING PACKAGE** Combined Company Sales, Company Purchases, General Accounting, and ADD systems .... £950/£45

☐ (L) **SALES ORDER PROCESSING PACKAGE** – Combined Stock Control, Order Entry and Invoicing and ADD systems .... £550/£30

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☐ **ANALYST** – Customised data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval and update facility makes information management easy. Sophisticated report generator provides customised reports using selected records with multiple level breakpoints for summarisation. Requires CBASIC-2, 24 x 80 CRT, printer and 48K system .... £125/£10

☐ **LETTERIGHT** – Program to create edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 .... £105/£15

☐ **NAD** Name and Address selection system – interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 .... £45/£12

☐ **QSORT** – Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. Parameter file created optionally with interactive program which requires CBASIC-2. Parameter file may be generated with CP/M assembler utility .... £50/£12

SOFTWARE SYSTEMS

☐ (M) **CBASIC-2** Disk Extended BASIC – Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables etc. .... £75/£10

MICRO FOCUS

☐ (L) **STANDARD CIS COBOL** – ANSI '74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive dubug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal .... £400/£25

☐ (L) **FORMS 2** – CRT screen editor. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. Output is COBOL data descriptions for copying into CIS COBOL programs. No programming experience needed. Output program directly compiled by CIS COBOL (standard) .... £100/£12

OTHER

☐ **HDBS** – Hierarchical Data Base System. CODASYL orientated with FILEs, SETs, RECORDs and ITEMs which are all user defined. ADD, DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. SET ord... **NEW** is sorted, FIFO, LIFO, next ... prior. One to many set relationship supported. Read/Write protection at the FILE level. Support FILEs which extend over multiple floppy or hard disk devices.

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Software with Manual / Manual Alone

☐ **MDBS** – Micro Data Base System. Full network data base with all features of HDBS plus multi-level Read/Write protection for FILE, SET, RECORD and ITEM, explicit representation of one to one SET relationships. Supports multiple owner and multiple record types within SETs. HDBS files are fully compatible.

☐ **MDBS-DRS** – MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMs, RECORDs, or SETs are needed without changing existing data.
HDBS-Z80 version .... £135/£25
MDBS-Z80 version .... £395/£25
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Z80 version requires 20K RAM. 8080 version requires 24K RAM. (Memory requirements are additional to CP/M and application program.)

When ordering HDBS or MDBS please specify if the version required is for 1) Microsoft L80 i.e. FORTRAN-80, COBOL-80, BASIC COMPILER, 2) MBASIC 4, XX, or 3) BASIC-80 5.0.

☐ Ⓛ **PASCAL/M** – Compiler generates P code from extended language implementation of standard PASCAL. Supports overlay structure through additional procedures and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Untyped files allow memory image I/O. Requires 56K CP/M .... £195/£20

☐ **PASCAL/Z** – Z80 native code PASCAL compiler. Produces optimised portable reentrant code. All interfacing to CP/M is through the support library. The package includes compiler companion macro assembler and source for the library. Requires 56K and Z80 CPU. Version 2 includes all of Jensen/Wirth except variant records .... £155/£15

Version 3 Upgrade with variant records and strings expected 2/80 .... £205/£15

☐ Ⓜ Ⓛ **PASCAL/MT** – Subset of standard PASCAL. Generates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD-9511 hardware floating point. Version 3 includes Sets, Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the run time package requires MAC (See under Digital Research). Requires 32K. .... £135/£20

☐ **TINY C** – interactive interpretive system for teaching structured programming techniques. Manual includes full source listings .... £45/£30

☐ Ⓜ **BDS C COMPILER** – Supports most major features of language, including Structures, Arrays, Pointers, recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie .... £60/£10

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☐ Ⓜ **POLYVUE/80** – Full screen editor for any CRT with XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive 70 page manual .... £70/£12

☐ Ⓜ **POLYTEXT/80** – Text formatter for word processing applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Suport for Daisy Wheel printers includes variable pitch justification and motion optimization. .... £45/£10

☐ Ⓛ **ALGOL 60 Compiler** – Powerful block-structured language featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling, direct disk address I/O etc. Requires Z80 CPU .... £110/£12

☐ Ⓜ **Z80 Development Package** – Consists of (1) disk file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file for CP/M LOAD, DDT or SID facilities .... £50/£12

☐ Ⓜ **ZDT** – Z80 Debugger to trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. Facilities similar to DDT £20 when ordered with Z80. Development Package .... £30/£7

☐ **DISTEL** – Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL Xitan pseudo ops optional. Runs on 8080. .... £35/£7

☐ Ⓜ **DISILOG** – As Distel to Zilog Mostek mnemonic files. Runs on Z80 only .... £35/£7

☐ Ⓜ **TEXTWRITER III** – Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertion. Ideal for contracts manuals, etc. .... £75/£3

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☐ Ⓜ **POSTMASTER** – A comprehensive package for mail list maintenance that is completely menu driven. Features included keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2 .... £85/£10

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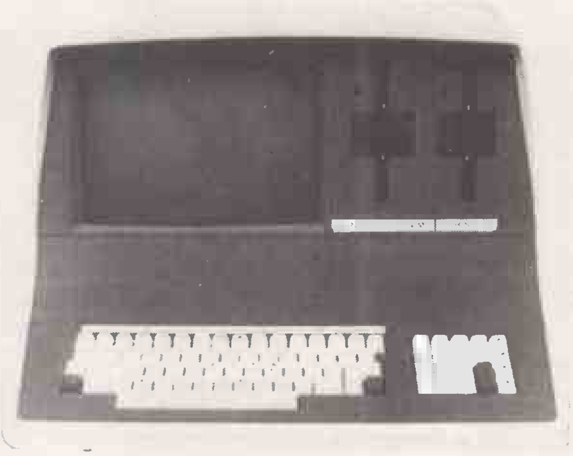

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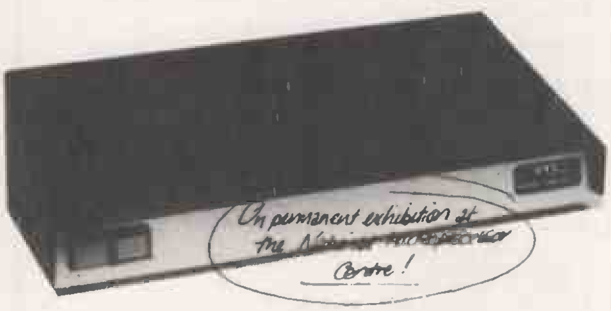

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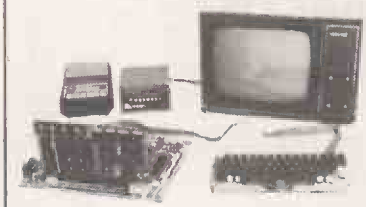

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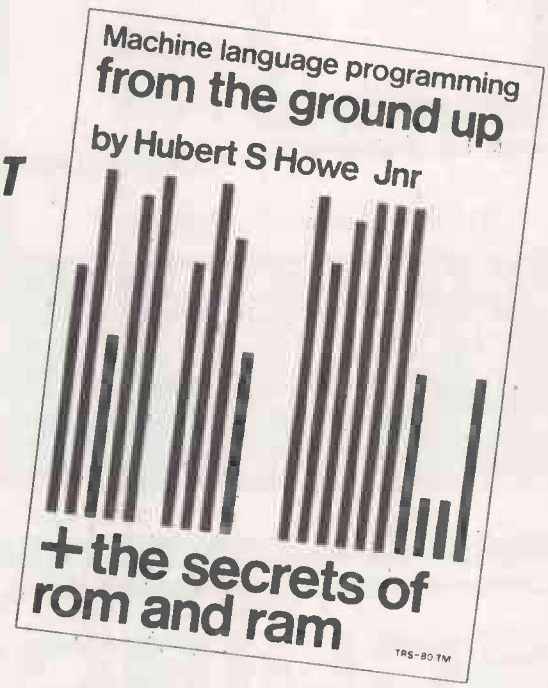

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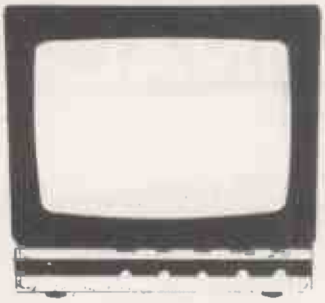

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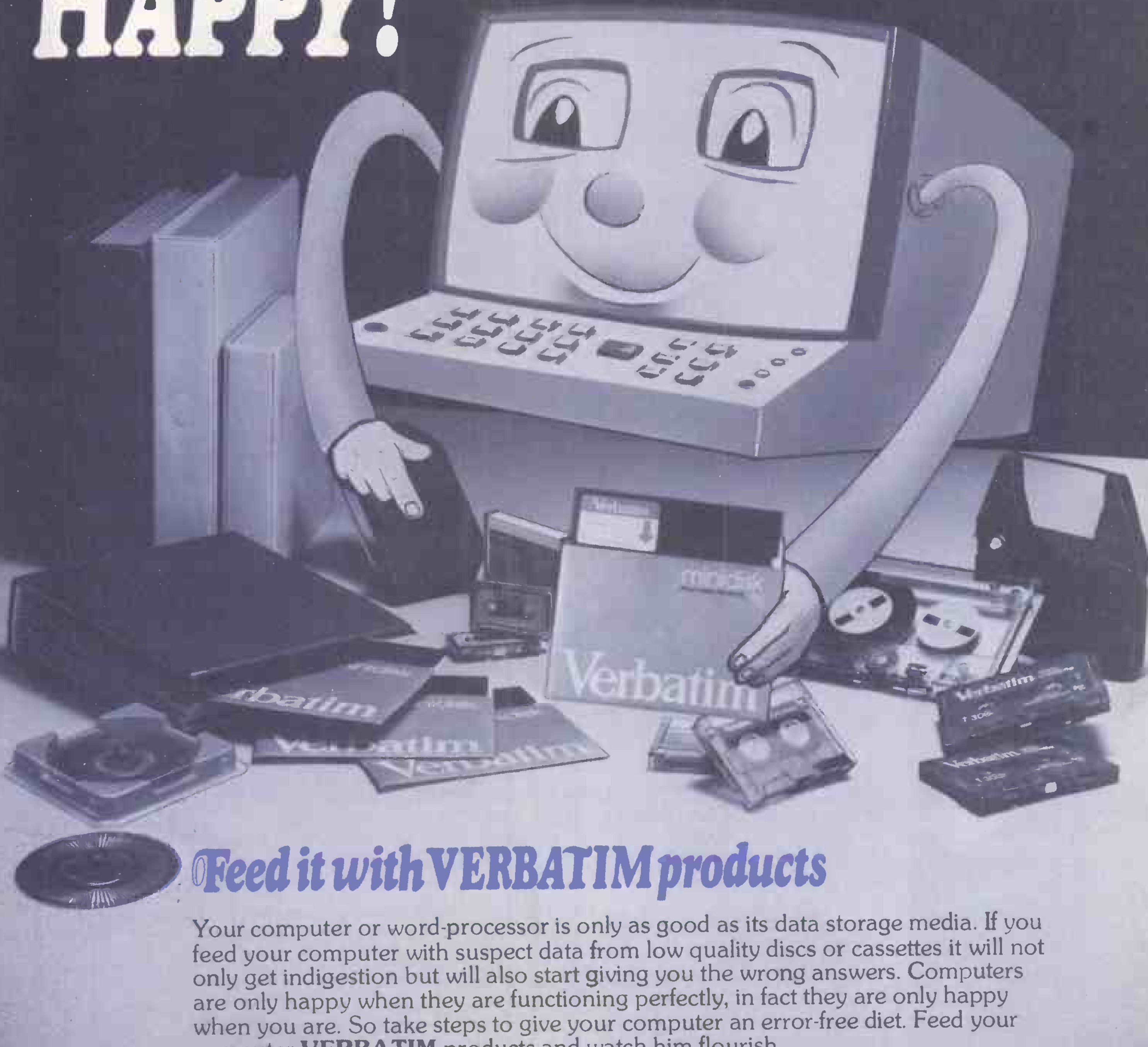

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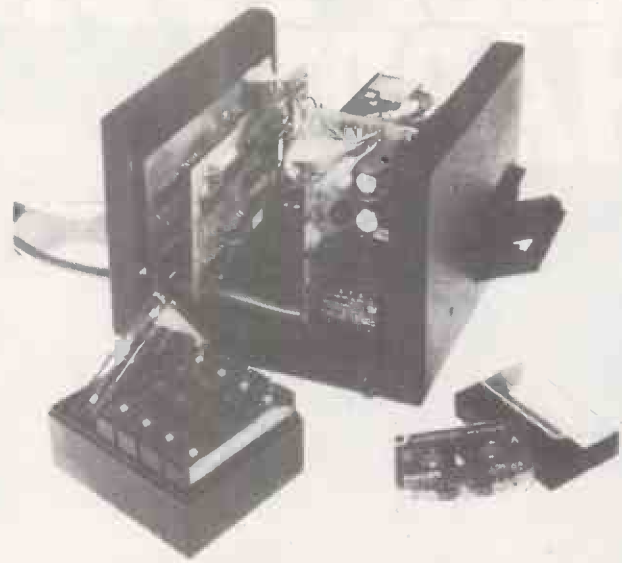

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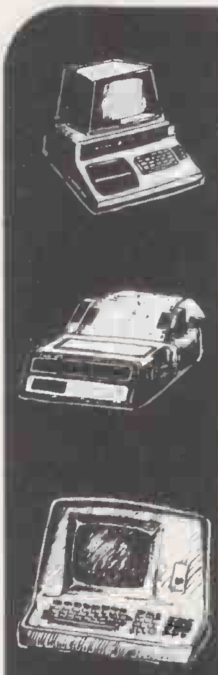

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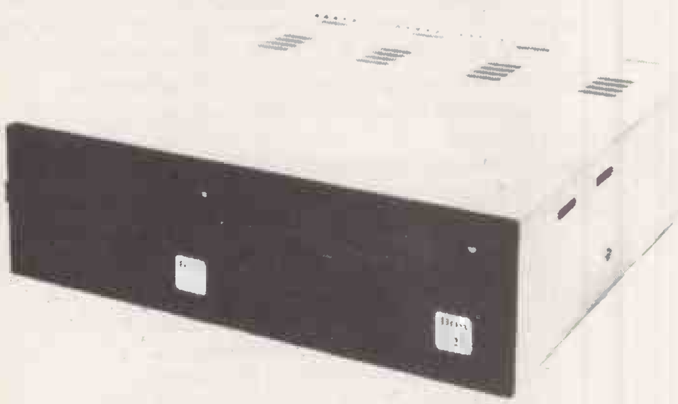

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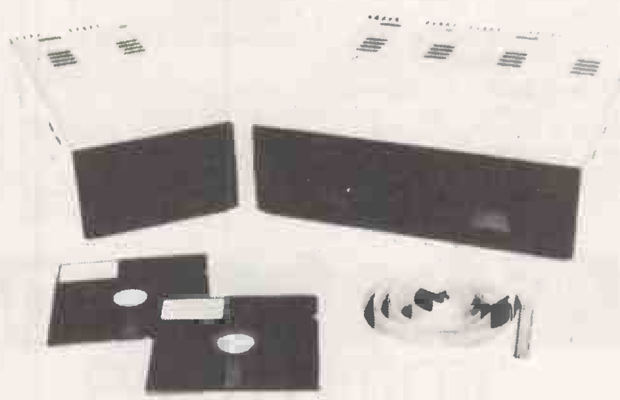

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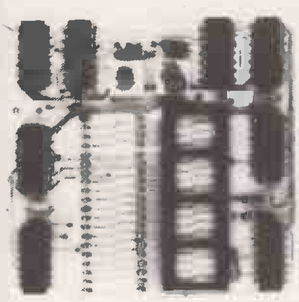

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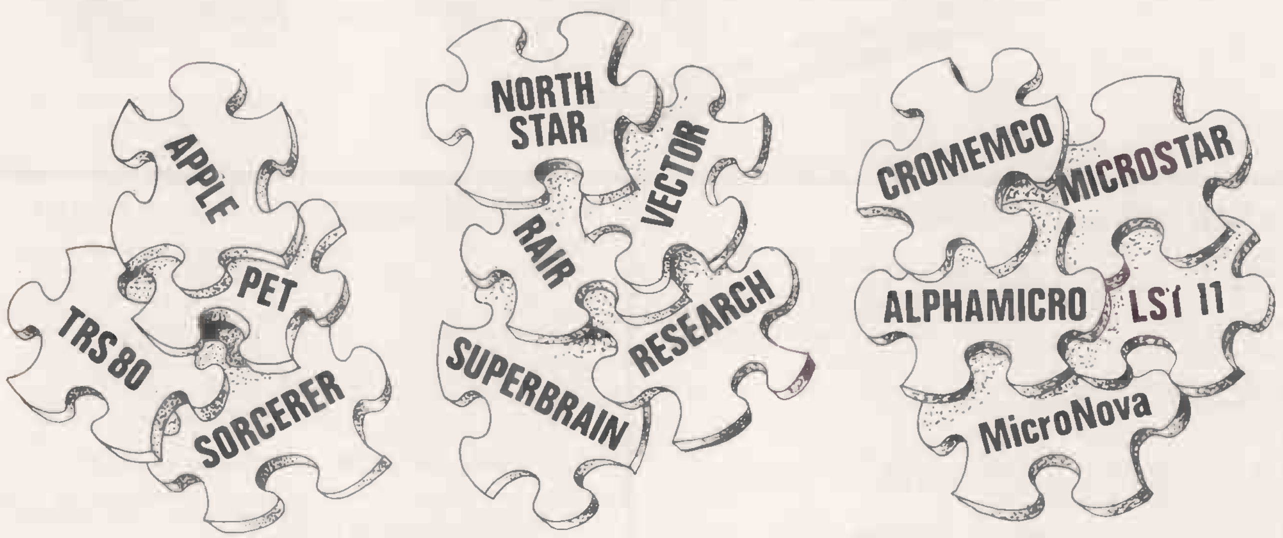

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Hopes which never came to fruition

IN THE dim long-ago of 1979, there was a myth — particularly in the *Practical Computing* offices — that the spread of microcomputers would unleash great surges of creativity among people with the newly-given power of computation.

Naturally, one expected the flowering to occur first in the U.S. because most of the world's micros are there and it is full of dynamic get-up-and-go people — so American, somehow. Then one hoped it would start to show in the U.K., perhaps not whole Chelsea Flower Shows, but at least a few bright green spears, a shy bud — perhaps even a petal unfolded to the wintry air.

What has happened? Since we started our Software Buyers' Guide, we are in a position to see what blossoms emerge and one had to admit that what we see is more like a vegetable garden than a flower bed.

There is a huge number of worthy commercial packages — mailing lists, purchase ledger, incomplete records — but almost nothing else. It is evident that a large number of people who were previously employed in writing worthy commercial packages for minis and mainframes have bravely taken their courage in both hands and done the same thing for micros.

After all, since minis and mainframes are expensive beasts, they tended to be used for worthy money-saving jobs. One wouldn't expect much imagination to play over their sombre grey boxes because of all the bureaucracy through which it would first have to filter.

In theory, micros are different. The idea is that a micro puts computing power in the hands of the man who needs it. He should then be able to apply it to all kinds of useful and interesting tasks.

Do we see many signs of that? Well, not really. We carry applications stories about people who are doing interesting things with micros. There are not as many as you might suppose and although what they are doing is interesting, it is usually strictly one-off. They often have no plans for marketing their software even if it could be turned into a saleable item.

Two British failings

In recent decades, the British have suffered commercially from two characteristic and almost lethal failings: we do things because they are interesting engineering — like Concorde; and having done them we do not market them properly.

In fact, very few people realise that it is usually much more difficult, exciting and expensive to market a product than to make it in the first place. Making machines or writing programs requires a simple struggle with nature, usually in her more brutish and predictable aspects.

Selling the result requires psychology of the nicest kind — a delicate appreciation of the lusts, hopes and fears of thousands of people you have never met.

There is a third British commercial sin — we go on doing what we have grown used to even when no-one has the least use for the result. If you want to see what happens then, take a swing through the northern U.K. industrial cities where this policy has produced memorable results.

Can it be we are seeing the same thing in our nice new floral kitchen garden? Does the U.K. really need 21 rival payroll packages for microcomputers, all, no doubt, ideal for any application? Is there room for 35 competing stock-control systems?

No doubt, the grim reaper will take his toll and reduce these numbers, but might not some of the effort have gone into less well-cultivated plots? It seems that there is an infuriating failure to communicate.

There are masses of people who know about useful things for micros to do, but they don't know they know because they don't know enough about micros. There are masses of other people who know how to make micros do tricks but cannot know what to make them do except apparently incomplete records and stock control. The two masses do not seem to have much to say to each other.

Myth of computing

Part of the trouble is the myth of computing fostered by the data-processing priesthood. How often one meets people who probably have a perfectly good idea for a program wafting around inside their heads if only they had the self-confidence to realise it, who say disarmingly: "I know nothing about computing at all. Much too clever for me".

Of course, the truth is that computing is childishly simple — just time-consuming. Yet you cannot persuade the layman of that and you can't dissuade the professional — he too has swallowed the myth, but to his own advantage. The result is that both sides are convinced they cannot talk to each other.

Until a new race of computer literates emerges from the nursery, we will have to manage as best we can by trying to persuade the two sides to collaborate. There needs to be much more communication than there is at the moment. *Practical Computing*, may we say it modestly, could be useful in this respect.

That brings us back to the U.S. question. If there is a lack of blossom here, how much more bleak is the U.S. scene? One would think that matters would be roaring ahead there with all kinds of exciting developments occurring on every hand, but this is not the case.

We read the U.S. magazines with close attention, we scan the advertisements and pore over the articles. We go to their shows and buttonhole travellers from those fabled shores with wearisome curiosity and are rewarded with a mouthful of ashes.

Few U.S. authors aspire higher than a central-heating controller and many not so high as that. It could be, of course, that talent which one might have expected to go into articles is being spent on commercially-available software, but that too does not seem to be the case. The most exciting recent offering is a program which advises you on sexual athletics.

The Americans seem terribly good at hardware. They seem able to organise the considerable effort that operating systems and languages need, but seem to fail when it comes to individual imagination.

One hopes that the British, in their sturdy pragmatic way, might do better.

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

A good programmer

WHAT makes a good programmer? A good programmer is one who can be relied on to produce good programs, on time — a good program has several important characteristics. It must be correct, that is, it must produce correct output for all correct inputs.

It must be robust, which means it must handle all incorrect inputs sensibly. It must be well-documented, both for the users and for maintenance purposes. It must be understandable and free of unnecessary, clever programming tricks.

It must be easy to modify, which implies a clear modular structure, designed with likely modifications in mind. It must be convenient to use. It must be free of surprises and edge-effects so that, for instance, a sort routine must not fail if presented with only one item to sort, and the sorting-time must not increase unreasonably as the number of items increases. Finally, the program must be compact and efficient.

A good programmer, furthermore, will keep these goals in perspective. There are no prizes for saving 200 bytes in a 2Kb application for a Pet, if there is no pressing need to use those 200 bytes for another purpose.

Similarly, the documentation required for a payroll package obviously exceeds the documentation required for a one-off program to calculate the date of Easter.

So what makes a good programmer? Not the skills most people assume: for example, the ability to write clear, concise, unambiguous English is far more important than fluency in 6502 machine code or Pascal.

A good programmer can learn a new programming language in a week; a poor one may know a machine inside-out and still be incapable of writing good programs.

No, good programmers are those who have the ability to think clearly, logically and abstractly and to write down their thoughts. They also have an armoury of other skills: knowledge of particular algorithms; knowledge of data structures, knowledge of the many techniques other people have used to analyse and solve their problems.

A catalogue of the things a good programmer should know would take a whole article, but it should be clear by now that people become good programmers by working hard at it, and in particular by reading and studying programs as well as by constructing and writing programs of their own.

All that has been by way of background to the main point of this letter. The editorial in May criticised the Government for planning to spend £9 million on teaching computing and providing software for schools, rather than on buying microcomputer hardware.

The editorial argued that schoolchildren had the enthusiasm and ability to turn themselves into good programmers without help or tuition, and accused the software industry of elitism and of trying to organise a closed shop. I do not believe that to be the case.

Computers can serve many purposes in the school curriculum. They can be used to teach computer awareness, so that all schoolchildren develop an understanding of the power and the limitations of computers. They can be used as a tool, to teach any subject from remedial English to nuclear physics.

They can be used to teach the use of a computer as a personal tool, like an advanced pocket calculator. They can be used to teach computer science, as a step towards a job in the computer industry. Only in the first of these will most schoolchildren learn enough by themselves.

If the beginner is going to progress to any serious computer programming, it is important that suitable attitudes and methods are learnt early; otherwise it is almost inevitable that he will develop habits which work well enough for simple programs but which are unsafe or disastrous for more complex problems.

The scope for error is enormous, especially in numerical or systems software. There are programming styles and methodologies which reduce the probability of error dramatically, but they are difficult to develop by oneself.

The good programmer, above all, knows his limitations. Industry needs good programmers and, if the schools are to help provide them, schoolchildren must be taught to program; taught to benefit from the progress we have made so far. Enthusiasm and the ability to write excellent Basic must not be confused with good programming.

Martyn Thomas,
South-west Universities
Regional Computer Centre.

Industrial applications

I HAVE recently bought a Nascom 1 and have the usual games on tape. I would like to hear from anyone who can give me any help in using a micro in industrial applications using it to control machine operations, relays, valves and proximity switches, etc.

I would like to work towards a system which would give a printout, or other visual display, indicating when a fault had occurred and which part had failed to function.

The situation in which the micro would operate would exclude the Nascom 1, so if anyone with ideas about incorporating micros — not just the Z-80 — could contact me, I would be very pleased to hear from them.

Also if anyone knows of any courses which cover hardware interfacing, I would be grateful for the information.

B Taylor,
Backup,
Lancashire.

Novice's tribulations

AS A newcomer to computing — I assembled my UK101 about three months ago — I sometimes cannot decide if it is better to jump in head first and hope I land on my feet, or wait until some friendly magazine such as *Practical Computing* spells it out for me.

I thought it wisest not to buy cassette software but instead write my own. That way you learn more quickly, I think, and I am proud of my version of Pinball.

I have also keyed-in and altered programs published in magazines. I have been tempted by add-ons for my UK101 and disappointed in one case, and bewildered and confused in two others. I bought and assembled a £45 colour graphics kit, but returned it when I discovered that the UK101 graphics characters were lost if the colour add-on unit was used, because the eighth bit is used to define colour. A dot and/or Pixel was more like a chunk or block. The extra programming instructions slowed basic graphics routines even more.

After receiving the refund, I thought sound effects and music would be fun, so I ordered the A7-3-8910 chip with 64-page manual. I naively thought I would be able to interface this chip to the UK101, although slotting it into the memory map worried me a little. Address decoding with mixtures of gates seemed somewhat complicated.

Also, I hoped I would be able to program the beast in Basic, but later discovered it must be in machine code.

(continued on page 46)

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(continued from page 44)

I ordered and assembled the Hyspec I/O board. I thought it would allow easy interfacing to the A7-3-8910, and thanks to a friendly letter from Hyspec, I discovered it does. I also discovered that Hyspec is producing a sound board for the UK101 with the A7-3-8910 as the programmable sound generator.

Hyspec has been kind enough to agree to supply the kit less the integrated circuit which I already have. It also seems that I will be able to program sound using Basic with machine-code subroutines using POKEII, O: POKEII,5:X = USR(X).

I decided once again to plunge in at the deep-end and ordered the UK101 assembler, but the manual, while being an ideal technical reference for the experienced is of little use to the novice.

It states that the assembler needs 8K of memory and that is exactly what I have. I assume that it means use only page zero for programs. Having loaded and run the program, if I want to alter it, I must save it on tape as the assembler also uses page zero. To use it again, I have to answer INIZ? with "Y", thereby clearing page zero.

Perhaps someone would help me. A program to white-out the screen would be a start.

David Henniker,
Edinburgh.

Motorola meeting

I AM arranging a meeting at the North-east Wales institute of higher education on Monday, September 15 to discuss educational software for Motorola 6800 and 6809 microprocessors.

The results achieved by educational establishments using 6800-based systems over the past few years, will be co-ordinated and a central library of educational programs established.

Standards for program writing will also be discussed for assembly and high-level languages, so that all library programs can be used and altered easily.

I hope that the meeting will also act as a forum where new ideas and developments in educational software for M6800 and 6809 micros can be discussed.

If anyone wishes to attend the meeting, or would like more information, ring me on Deeside 816236, ext. 33, or write to: The Microprocessor Centre (NEWI), The Coach House, Kelsterton Road, Flint, Clwyd, CH6 5TH.

Margaret Williams,
Flint,
Clwyd.

Praise for Pascal

PASCAL has received something of a battering in your magazine recently, mostly it would seem from people who know little about it, so I would like to redress the balance.

Pascal, in contrast to Basic, is as much as possible problem-orientated and as little as possible machine-orientated. That means that to use it successfully, it is necessary to think in Pascal, and entirely put aside considerations of machine architecture, leaving them to be dealt with by the compiler.

I suspect that people who enter computing from an electronics background have trouble with Pascal because they are so accustomed to thinking in machine-orientated terms, and prefer to return to Basic or machine code when they realise that learning Pascal implies something more fundamental than learning a new syntax.

However, complete newcomers to computing do not experience the problem, and I suspect they find Pascal rather more attractive since it has far fewer niggling restrictions than Basic. With experience they can benefit from its extensive facilities.

The main problem with Pascal is implementing it successfully on hobby-sized computers, bearing in mind that a successful system requires rather more than merely writing a compiler.

However, such systems should soon be available, and then I expect that the use of Pascal will become usual, although sheer inertia will ensure the survival and possibly dominance of Basic.

Paul Farrell,
Harborne,
Birmingham.

Powerful potential

I HAVE been using an Apple Pascal system since Christmas, 1979 and have so far had very few complaints. In fact, I consider the system worthy of great praise. My own particular use for the system is in a scientific application requiring periodical fast data acquisition via A/D conversion — 12-bit 50 readings/second — and analysis of that data in real-time.

To do that, I have made full use of the very versatile 6502 assembler to develop the low-level routines necessary to access data from a 12-bit A/D converter, Mountain Hardware real-time clock and a home-brewed 16-bit frequency counter. The assembler has several useful features which aid the efficiency and readability of the assembly language:

Macro facility directives where a named macro routine may be referred to by any procedure or function in the assembly file and parameters in the form of addresses may be passed over.

Conditional assembly directives namely: . IF . ELSE . ENDC may be nested if required.

Pascal host communication directives which control freedom of information between host and assembly programs. . CONST global constant declared in the host and assembly which can be referred to subsequently in the assembly or host program. . PUBLIC a global variable declared in both the host and assembly which can be referred to subsequently by either. . PRIVATE a global variable declared in the assembly which retains its value throughout the program.

External reference directives: . DEF can be used to refer to labels in any assembly function or procedure and can be called subsequently by any other assembly routine using . REF.

Unfortunately, I now find I have great problems in analysing the data using complex numerical software routines in the host program. The reason for that is the format of real numbers in UCSD Pascal: the mantissa has 23 bits which absorbs only six-digit precision.

Routines such as a least-squares-quadratic fit, using the normal equations, include summations involving X axial values raised to the fourth power. Hence, working to 10-bit precision in the X values requires at least 40-bit precision in those terms to the fourth power.

Pascal also supports the type-long integer which may be declared to be up to 32 digits — 100 bits — and used for high precision addition, subtraction and multiplication. Unfortunately, difficulties arise with division using the standard integer division operator DIV, which truncates the result to return an integer result.

Thus to retain high-precision, one must check the relative size of the terms either side of the operator and adjust accordingly before division. Alternatively, both terms may be converted to real numbers using the following function:

```
FUNCTION INTOREAL (NUMBER : LINTEGER) : REAL; (* LINTEGER must be
declared globally as a type INTEGER [32]
for successful complication*)
VAR I: INTEGER;
NUM : REAL;
NUMSTR : STRING;
BEGIN
NUM : 0 ;
STR (NUMBER, NUMSTR);
(* converts long integer to a string*)
FOR I : = 1 TO (LENGTH NUMSTR) DO
NUM : NUM * 10 + (ORD (NUMSTR [I]) —
ORD ("0");
INTOREAL : = NUM;
END;
```

before ordinary gloating point division (/).

In some cases, it is necessary to convert a result back to a long integer. That also causes problems because to do that and retain the required number of digits, one must first multiply the real by at least 1,000 and round or truncate the result.

That converts it to a normal integer with the maximum value of 32,767. There is no function available in Pascal to convert reals directly into long integers. The nett result of these clumsy manipulations is a very slowly-moving algorithmic mess with uncertain precision.

It seems a great pity that such a potentially powerful system should be limited to single-precision 32-bit real-numbers.

Phil Nott,
Department of Biochemistry,
Leicester University.

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Prestel fails to find expected success

THE Post Office, or British Telecom as it should now be called, projection for its Prestel service seems to have gone badly astray. When the service was formally launched earlier this year with a massive advertising campaign, there were barely 3,000 sets in operation, mainly with official Information Providers.

At the time, the Post Office predicted that the campaign would sell nearly 50,000 sets by the end of the year. At the moment there are less than 5,000 sets in operation.

The reason for the slow growth is this market is the sheer expense of the Prestel sets. Judging by the response to the *Practical Computing* pages of Prestel, the key buyers are people interested in high technology and linking their sets to their personal computers, and who have cash to spend.

A cheaper alternative is now available in the form of a black box Prestel-adaptor which will sell at around £100. Developed by Ayr Viewdata, with technical help from Technalogics, the unit should now be available in limited numbers.

The Prestel adaptor, which has taken Ayr 12 months to develop, is a compact 12 in. by 7 in. by 3½ in. unit, in teak or black metal finish. It can be placed on top of a TV set, or wall-mounted to connect it to the Post Office line for call-up and reception of the Prestel information. The unit is self-contained with internal modem and auto-dialer and is complete with infra-red hand-held keypad for remote-control operation.

Ayr Viewdata is based in Surbiton, Surrey. Telephone: 01- 399 6521.

Human brain still ahead

AN ITEM which puts everything back into perspective is this table compiled by RCA Corporation Advanced Technology Laboratories which compares memory capacities. It was published in *Business News*.

Memory device	Storage capacity millions of characters
Human brain	125,000,000
U.S. National Archives	12,500,000
IBM magnetic cartridge 3850	250,000
Encyclopedia Britannica	12,500
Hard disc	313
Floppy disc	2.5
Book	1.3

Survey reveals unknown facts about computing in schools

NOBODY seems to be very certain how many schools are now using microcomputers except that there are probably many more than the Government estimates.

A joint survey by the Council for Educational Technology and the Schools Council has just been completed and suggests that of those schools which have taken the plunge and bought a microcomputer, most have only one system.

The Council had returns from 60 out of 104 local education authorities in England and Wales which showed that 663 secondary schools in the maintained sector, from a total of 4,988, had microcomputers or had them on order.

Reported applications showed a very high proportion being used for familiarisation and computer studies to CSE/O level, with significant numbers of schools using them for computer-aided learning and for school administration.

Although the Council recognises that the survey has a very limited use, a computer database is being established to which additional information can be added.

Latest Pet-compatible floppy drive will double on-line data storage

A NEW floppy disc drive which doubles the on-line data storage available on the Commodore Pet has been launched by ACT.

Rated at 2Mbytes unformatted, the ACT drive unit offers Pet users a total of 1.6Mbytes on-line.

The double-sided, quadruple-density drive unit, available in two models, is compatible not only with existing new-ROM Pets, but also with the large screen model 8032 Pets announced recently by Commodore.

The new 2Mbyte Pet-compatible floppy disc drive from ACT.

It is manufactured by the ACT associate corporation in California, CompuThink Inc and is based on the CompuThink disc units, marketed in Europe and the U.K. by ACT.

The features included on the new unit include a fast data transfer — 15Kbytes per second — the Diskmon operating system and random, or sequential file access.

There is one file per track and 79 tracks per side.

Software developed for the existing ACT drives runs on the unit using a simple once-only conversion routine supplied with the drive unit.

Priced at £1,395 + VAT more details are available from ACT on 021-455 9898.

Fortronic has new system

A NEW British-designed and built development system has been launched by the Scottish-based technology company, Fortronic. Designated the F-500, the new 6809-based microprocessor system has a very wide range of communications facilities.

By means of various plug-in boards, the F-500 can be used as a tool for hardware or software development work and can be used as a branch controller, a front-end processor or a data processor for both commercial and technical applications.

Software includes Basic, Fortran, Pascal and assembler. For details: (0383) 823121.

ALTHOUGH most microcomputer users have no difficulty in memorising the control functions of a word-processing package, there still seems to be a market for specialist keyboards on which all names of control keys are clearly marked. The latest has been engraved with the Wordstar functions and is available from Elbit Data Systems of Slough, (0753) 26713.

Ascribe has Arabic character capability

MIDDLE Eastern readers might be interested in a new VDU which is claimed to be the only bi-lingual VDU both to alter Arabic characters to their correct start/medial/terminator forms automatically and position characters for correct left-to-right or right-to-left addressing.

The Arabic alphabet has letters which alter shape according to their position in the word. The new VDU, the Ascribe, chooses the proper shape automatically.

Arabic letters are also written from right to left although numbers, even in Arabic text, are still written from the left. The Ascribe also handles that problem. For more details telephone Terminal Display systems on Blackburn (0254) 662244.

Uncertainty over future of Nascom does not stop new wave of add-ons

DESPITE the problems and confusion still surrounding the future of Nascom, the rash of new add-on peripherals for the popular system seems to be continuing.

One of the more useful is a tool kit, from Bits and PCs, for the Nascom 8K Basic. It is supplied in two 2708 EPROMs for use with the Nascom 2, or on tape for the Nascom 1. The tool kit is fully re-locatable and is menu driven.

Its facilities include a keyboard repeat in either basic or machine code, a printer handshake routine, an auto line number, delete, append, re-number, Hex which will convert up to 10 lines from Hex to decimal in one operation, Help which will put the offending error line as the top of the screen, Find which will find a given string, Off, Dump and an Inkey. At a cost of £42 the Tool Kit is available from 18 Rye Garth, Wetherby, West Yorkshire LS22 4UL (0937) 63744.

Another useful item, from Interface Components, is an EPROM board which can access up to 40K of firmware. Designed to full Nasbus specifications, the board has 16 sockets to take 2708s or 2716s. The sockets are organised in four banks of four and, as long as each bank has the same EPROMs, banks can be mixed between 2708s and 2716s.

Each bank can be decoded to start at any 4K address boundary. As an example, the board can be fitted with the Naspen text editor, Zeap assembler, Nas-Dis disassembler and Nas-Debug and still have six spare sockets for user's firmware.

For Nascom 2s, the board has been fitted with a wait-state option which allows the microprocessors to operate at 4MHz with slower EPROMs. More details are available from Interface on Amersham (02403) 22307.

If you can afford it, Microdata Computers is now offering a combined bubble memory and real-time clock board for the Nascom which can be plugged into the standrd 77-way Nasbus. The capacity is 92,304 bits and the initialisation routines and the operating system are supplied in a 2708 EPROM.

There is a battery back-up which will power the clock chip for approximately 12 months in the absence of power. Details from Microdata on 01-848 9871.

Last, but not least, is a new moulded plastic case for the Nascom 1, which can also be used with the Superboard and the UK101. The Model 3 from Microtype is larger than its predecessor, allowing greater space for expansion and has a pre-cut keyboard.

A blank panel will also be available. At a cost of £24.50 the case is available from Microtype at PO Box 104, Hemel Hempstead, Herts.

The moulded plastic case for the Nascom I, Superboard and UK101 is available from Microtype.

Literacy for micro is here

THE SLOW march towards giving the micro some semblance of human verbal skills takes another step forward with the release of a program called Corrector which detects and corrects spelling mistakes in English text. It is sold by Southdata Ltd for Z-80 CP/M systems with eight-in. discs.

It claims its only competitor is the IBM Displaywriter which IBM calls one of the wonders of the Information Age. Southdata points out that its product allows the user to add 20,000 words of his own to the 25,000-word list supplied by the Oxford University Press which Corrector uses. It could prove very useful for people in disciplines which have a technical vocabulary unfamiliar to the average typist. Corrector will be incorporated in a word-processing program. One of the partners of Southdata is Peter Laurie, editor of *Practical Computing*. Southdata is based at 221 Portobello Road, London.

Inmos decision

AFTER a delay of nearly seven months and much speculation that the project would be cancelled, the Government has finally decided to back Inmos with a further grant of £25 million, making a total investment of £50 million, to build a U.K.-based plant to produce advanced memory chips. The new plant will be built in south Wales, rather than the site preferred by Inmos in Bristol.

The announcement of the decision was made by the Prime Minister in the House of Commons as part of a package of proposals which the Government hopes will take the steam out of the rising furore about the high level of unemployment.

Sir Keith Joseph, Secretary of State for Industry, later claimed that the decision to force Inmos to build the factory in south Wales had been made by the National Enterprise Board and not by the Government.

He said that the Government gave the go-ahead to the scheme only after the NEB had completed its latest review of the Inmos business plan. The NEB strongly recommended that Inmos should be backed and that top priority should be given to building the new factory.

Job creation

The basis for the recommendation was that Inmos had indicated it would be willing to accept the decision to build the factory in south Wales, an area of high unemployment caused by redundancies in the steel and coal industries, rather than in Bristol where Inmos already has its U.K. development centre.

Inmos believes that the production plant will lead to the creation of more than 2,000 new jobs over the next three to four years. A second U.K. factory, also to be located in a depressed area, is planned. It should provide a further 1,650 jobs by 1985 and the NEB calculates that there will be a build-up of a similar number of jobs among Inmos suppliers in the U.K.

Inmos already has a technology centre and a production plant in Colorado Springs in the U.S.

After the Prime Minister's accouncement, the National Enterprise Board said that its review of the Inmos business plan had confirmed that the company progress in its first products was excellent and that it believed that the project stood a good chance of success.

The NEB also said that one of the advantages of locating the plant in south Wales is that Inmos will be able to apply for regional development grants both from the Government and the EEC.

Volume production

Inmos is reported to be happy with the decision and believes that it will prosper despite the separation of the plant and the technology centre.

Nick Edwards, the Secretary of State for Wales, says that there are a number of ideal sites close to Cardiff and Newport in Gwent and that with top priority being given, the plant should be ready for volume production of chips by the beginning of 1982, as proposed in the orginal business plan.

Main argument

The aim and the promise of Inmos is to give the U.K. an independent capability in the volume manufacture of advanced microchips. Some U.K. companies are already at the leading edge of chip design but have never been able to make the leap over to the mass production of standard chips.

One of the arguments against Inmos is that several U.S. companies are already manufacturing chips in the U.K. notably National Semiconductor and Motorola.

Inmos claims, however, that although those companies can produce chips in the U.K., all the development work will remain in the U.S.

British companies will never have the first priority in ordering the latest chips and incorporating them into new products ahead of the competition.

The Inmos business plan is to gain a toehold in the chip market by manufacturing well-designed LSI chips, such as the 16K static RAM and 64K dynamic RAMs in the hope that they can create enough capital, experience and reputation to enable the company to stand high among the leaders in the field.

It is possible that the Inmos chips will be better and more advanced than the competition because, odd as it may sound in this relatively young industry, many of its competitors are using what is now almost obsolete production equipment.

Companies such as Intel have had to invest fortunes in the existing chip printing technologies and cannot afford to write off their investment simply because more advanced equipment has become available. Inmos executives hope that their plant will be one of the best equipped in the world.

The sceptics who claim that the Inmos project is bound to fail are mainly competitors and should perhaps not be taken too seriously. It is true of most chips that it is not necessarily the best chips which win the market but the first ones which can be supplied in sufficiently large quantities.

Small investment

Despite all the hopes and dreams, £50 million is still a small amount of money to invest in such an ambitious project when compared to the fortunes being invested, over a far longer period, by the competition.

It is unlikely that Inmos would be able to persuade the Government to inject any further cash should the company fail to get off the ground with this generation of chips.

Despite the risks, the NEB is optimistic that Inmos will start making profits by 1984

Background

The Inmos saga goes back to March 1978 when the BBC *Horizon* program, When the Chips are Down, shook the then Prime Minister, Jim Callaghan, into telling his civil servants to invent some schemes for spending money on microchips.

Within a matter of months three leading chip designers in the U.S., Iann Barron, a British expatriate, Paul Schroeder and Richard Petritz approached the Government with the idea of launching Inmos as a British-owned mass-volume chip manufacturer.

The Government agreed readily to the plan and gave £25 million to establish a development plant and factory in Colorado Springs and a development centre in Bristol, with the promise of a further £25 million for a U.K. factory at the beginning of 1980.

With the change of Government in May 1979, the atmosphere changed. The new Government was intent on cutting public expenditure and was especially wary of state interference or the support of industry with direct grants.

What made matters worse in the eyes of the Government was that each of the three founding fathers stands to gain from the investment as part of the deal negotiated originally by Jim Callaghan.

Another problem the company faced is that many MPs from areas of the country with high unemployment objected to the company plans to create so many new jobs in the relatively affluent area of Bristol.

When the company approached the NEB at the end of 1979 for the cash to build its U.K. plant, the decision was left in the hands of Sir Keith. His department had to supply the NEB with the money.

Sir Keith is now reported to have been in favour of the project from early in the year but had to face opposition from Mrs Thatcher and those MPs advocating the establishment of the plant in a depressed area.

It appears that it was about this time that Mrs Thatcher switched her support to the plan with the proviso that the plant would be sited in Wales. Word came from Inmos, in June, that it would be willing to move.

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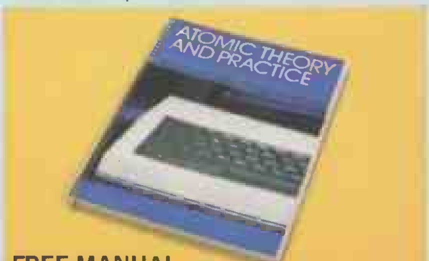

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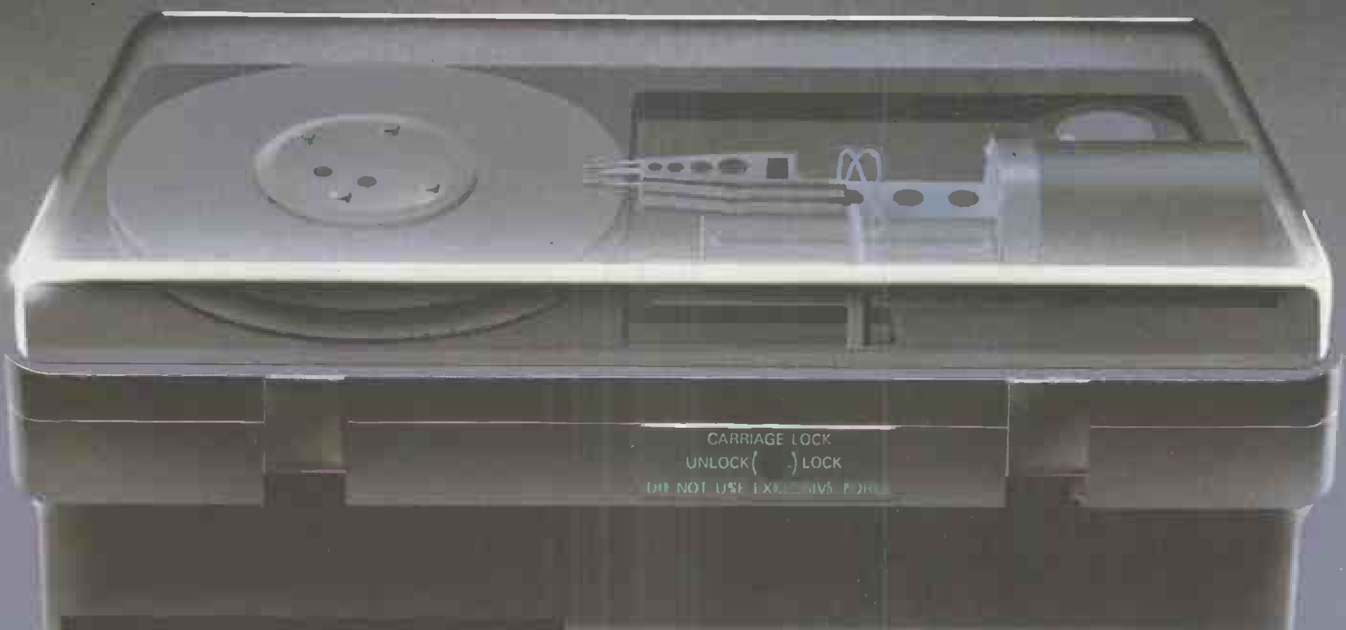

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Cash and chip shortages put firms in financial straits

"IF I hear anyone else open a conversation by saying I've this great idea that will knock the opposition for six, I am going to lock the telephone in the drawer", remarked a colleague recently, apropos of the umpteenth attempt to persuade him that the world was about to be turned upside down.

Communications may be in their biggest state of flux ever, but it depends as always on the willingness of the interlocutor to listen.

Meanwhile, there are many voices talking and sometimes one thinks, talking to themselves. In the event of failing to find an audience, who better to convince than onself? The self-proclaimed tycoon in the micro business is no rare animal but those who consolidate on the cottage industry will be few.

The giants are waiting in the wings to swallow those, as some of the year's struggles demonstrate already, such as: Compelec, Byte Shop, Abacus, Nascom, Microdigital, Isher-Woods.

Money problems

The problem, as always, is lack of money. Money is very now expensive, and hard won in a risky venture like a micro business. The lead is set by the Government, whose grudging handing-over of the second Inmos £25 million tranche seems to rest on the demonstrable fact that 2,000 jobs will be created in south Wales and whose announcement, coincidentally enough, was on the same day as the disastrous June employment figures.

For companies producing goods or services the cash crisis is most acute. The case of Nascom is the most obvious of those mentioned: a breakthrough into what looked like the big time, with limitless horizons and the proverbial crock of gold at the end of the rainbow.

A year after the launch in 1978, founder John Marshall needs more capital to finance the second generation Nascom 2 to succeed, or complement, the unexpectedly good reception of the Nascom 1. Unlike Nascom 1, which was designed round an existing source of components, the new Nascom 2 is designed on the basis of a promise to supply, in this case the new memory chip in an EPROM package. So already we have two external variables, neither in the company's control: component supply and money supply.

In the case of the components, delays became so serious that the Nascom 2 design had to be modified to make some sales to find cash for the company, which in the meantime had spent much of its backer's money.

The backer, impatient and probably fretful at what is, after all, an investment in a high-risk business, decided he could wait no longer and declined to make any further cash available. With the company unable to meet is debts, the receiver was called.

Obviously, the company wants to keep selling machines which are built and in stock turnover was claimed to be £250,000 in April, with 1,000 sales a month forecast. The interesting co-operative ownership scheme proposed by the Nascom users' club chief, John Margetts, looks unwieldy and unlikely to succeed, though the receiver has done all within its power to give time to find the money.

by Martin Hayman

Margetts is one of the few people willing to talk about Nascom. As head of the Nascom users' club, his interest is not, he says, financial. He sees his role as that of a catalyst; if his bid were to succeed, he regards his part in the business as finished. "I already have a good job as a components engineer", he told me, "so I wouldn't want to become involved in managing the company. It's just that, as an engineer, I don't like to see engineering companies in trouble. I've never done anything like this before — if someone had told me six months ago that I'd be trying to raise £500,000, I would never have believed them".

Margett's reasoning is that Nascom users are very loyal to their machine, in his experience, and there are 20,000 owners and a great many more users in the U.K. If half of those owners were prepared to invest an average of £50 each — there's £500,000. There is no guarantee, of course, that that sum will secure Nascom.

The receiver is not bound, of course, to accept the highest tender. His criterion is that the bid should be in the best interests of the company. In arriving at such a conclusion, he is assisted by the company founder, John Marshall. According to the receiver, there are several bidders in contention which apparently, according to Margetts, means three or four.

Cash was once again the problem at Abacus: the cash needed to feed the developing business, to consolidate its market position was not forthcoming.

Like Nascom, it needed either far more cash or to become part of a bigger group which already offered sales and service and cash back-up. The latter is what happened to Abacus when it was bought by south Wales-based Data Type, which specialises in terminals, media storage systems and a range of service skills — and includes, vitally for Abacus, 60 dealerships with field service engineers.

It would appear that Abacus was a more attractive prospect — perhaps because it is more of a service rather than a manufacturing outfit, perhaps because it was cheaper — the estimated cost to acquire it is £30-50,000. Derek Rowe of Abacus claims that there were about 25 prospective buyers. The main problem — the same problem Nascom faces — was to keep confidence going in the business to have some orders to fill once the necessary cash to re-capitalise the business was found.

Although it is now old news, the same scenario unfolds in the case of the Byte Shop, where again the backer pulled out, leaving the company unable to pay its way: the bills and the service claims, particularly on the Ohio Scientific equipment, mounted quickly. The revenue, from customers who expected to be billed after supply and sign the cheques after lunch rather than on receipt, slow.

Latest to suffer in the same way is Isher-Woods, the Luton-based firm which supplies Commodore Pet and other micros. The servicing arm of the company, RIIC Business Systems, had the most financial problems. The company lost its business mainstay, the Pet dealership, to nearby Computopia.

Future companies

Some companies seem to realise the problems. Microdigital, headed by Bruce Everiss and Graham Jones, has just been bought by Laskys, the hi-fi and video retailing chain which owns 40 shops throughout the U.K.

Laskys boss Peter Klein told me that this was not in response to Currys' move to bring micros into the toyshop, but then Laskys surely has enough credit to enable them to set-up a micro business without buying up an existing outfit.

Peter Klein may not be far off the mark when he describes the outfit of the future, with hi-fi, video, and home computer all compatibly rack-mounted for home or business installation — and above all, supplied and serviced by a big, anonymous electrical trader whose premises are just round the corner, rather than by a bright specialist whose time and talents are stretched to breaking point by trying to make the business work rather than concentrating on his forte of designing and developing more useful micros.

We evaluate the stock control package from Anagram Systems running on the Commodore 3032 with Commodore disc drives and printer. The package can carry up to 600 stock items on diskette and processes details of orders, allocations, and movements. Details of up to 255 suppliers can be held and all transactions are processed on entry so true stock levels are displayed.

Stock-control package written to professional standards

by Mike McDonald

ANAGRAM SYSTEMS is a small company based in Horsham and Crawley in West Sussex and specialises in commercial applications packages for the Commodore range. The programmers employed mostly have an IBM background which is reflected in the professional standard of the software packages. All packages are supplied as a set of object-code modules.

The entry of Anagram into the micro world resulted from a request from Amplicon Ltd for a commercial package for one of their Pet clients. On successful completion of the project, Anagram began to produce other packages and its range includes a sales ledger system. The prices for each of the packages are;

Stock control £395
Sales ledger £320

Main features

The main features of the stock control system are;

- Maintenance of stock item information including addition, deletion, amendment of items and enquiry.
- Recording of purchase order information for each stock item.
- Recording of all stock movements both in and out.
- Recording of allocated stock quantities before dispatch.
- Report production including
  Stock valuation at both cost and retail value
  Stock level highlights.
  Outstanding orders on each supplier.
  Stock card print for each item.
  Inactive stock items for a selected period.
  List of supplier names and addresses.

Each of the reports may be selected for whole file, a selected item, or in some cases for a range of items. The minimum configuration for running the package comprises a Commodore 32K microcomputer, CBM dual floppy disc drive and an 80-column printer.

The package is supplied as an A4 ring-bound, 48-page manual and a floppy diskette containing some 67 object modules and two sequential data files. Each of the object modules covers the varying functions of the package which are loaded and called in the course of running the system.

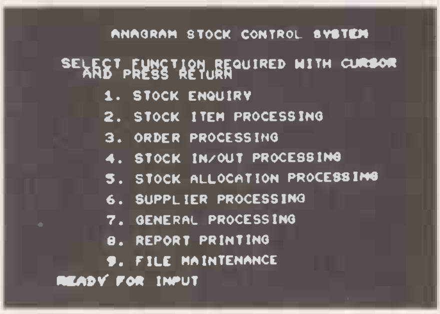
The modules occupy about two-thirds of the diskette and must remain mounted during the course of running — data is, therefore, held primarily on a separate disc mounted in the other drive.

The stock control system is a fixed-date system run on a calender-month basis and transaction dates must agree with the system date to avoid problems. Transactions are held in an open-item format and brought forward only at the month-end or if the condense-file routine is run to make more disc storage available.

The total capacity of the system will vary according to the mix suppliers/items/transactions but seems to utilise the limited storage with the maximum of efficiency.

All activities are totally interactive and the information held and displayed via a series of screen formats is always accessed for either enquiry or modification through the same formats.

The data organisation initially seems slightly complicated but the user soon



discovers that you store a series of items against which a series of incoming or outgoing transactions are entered.

All data is held in a single direct-access file on whatever free disc space is available. There are six types of record used in the system including —

1. General record
2. Supplier records
3. Main stock records
4. Order records
5. Stock movement records
6. Allocation records

The order, allocation and stock movement records are all sub-records of the main-stock record. The nature of the data held by the system which we found to be highly comprehensive can be illustrated best by examining each of the record types and its contents.

- **General record**

This record holds details of the five VAT rates. They may be added, altered, or deleted by the user and are stored as NN.NN%.

- **Supplier record**

Each contains a supplier code, name, and address. The name and address may be altered optionally by the user at any point or deleted and re-used. The supplier code must be a three-digit number with a maximum value of 255. The name and three address lines are allocated a generous 30 characters and a postcode field of eight characters has been thoughtfully provided.

- **Main stock record**

This is the largest of the records and contains the usual relevant information on each item held in stock. Records may be added, altered, and deleted and contain the following fields;

Stock reference — effectively the stock number but it is, in fact, a free-format field eight characters long and may contain a user-nominated identifier for each stock item providing it is unique. This field is mandatory.

Optional record

Description — may be 20 characters long and is optional but is used when displaying the stock index and ought, therefore, to be used.

Supplier code — this field may optionally contain the three-digit supplier number from which the stock is obtained.

Unit/model — may be used to further identify a stock item in terms of a model number, version number, etc., and is five characters long.

Quantity code — this field indicated the quantity in which the item is to be handled, stored, ordered, etc., and may consist of five characters.

Minimum stock level — an optional field that may contain six numeric digits, i.e., 999999. If left blank, the system does not

warn the user of minimum stock levels.
Maximum stock level — again, a six-digit field and will be used by the system for warning issue if used and exceeded.
Bin number/location — a very useful field up to four numeric characters long and used to identify the storage position or location of each item according to each user's system.
Cost price — an optional numeric field which may have a maximum value of 999,999.99 and is used for the stock valuation reporting.
Retail price — As the cost price field.
VAT rate — used to record the VAT rate in the form 99.99% and must agree with the value held on the general record.
Supersedes — a reference field only and may contain up to eight characters indicating a previously-held stock item.
Superseded by — again a reference field of eight characters pointing to a new stock line.

- **Order record**

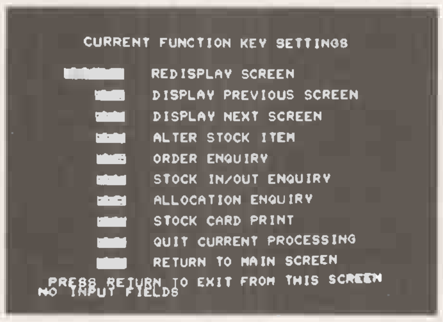
The ordering information is held on each one of these records and records may be added, altered, and deleted at will. The fields contained are;
Date of order — a mandatory field and must contain the date in the format DDMMMYY. That format is used consistantly throughout the package and must be adhered to as checking is carried-out against date entries.

Supplier code

Order number — the order number must be entered and may be up to five of any characters. Typically, it will be obtained from the order form.
Supplier code — used to identify the supplier for the order if different to that indicated on the main stock record as being the source supplier for the item ordered. If a supplier code is used which is not on the suppplier records, the system will reject the order. The field is optional.
Quantity ordered — a self-explanatory field with a maximum value of 999,999.
Orders received — this field is for completion on receipt of a delivery. If filled subsequently with, say, a partial delivery figure, the transaction will be held on the system through month-end routines and reported on in the outstanding order report.
Cost price — a sensible addition to permit a new cost price to be entered for each order if different to that held on the main stock record for the item ordered. If used, the system defaults all calculations to the value on the order recrod; May contain up to 999,999.99.
Date due — this should contain the delivery date in the form DDMMMYY and will be used for the outstanding order analysis or may be left blank.
Date arrived — normally updated when the order is received with the quantity-received field and is optional. Where numeric and alpha fields are used throughout the package, they are consistant and have the same pre-set limits, i.e., date, supplier code, stock number, price, quantity, and, will not, therefore, be defined in the balance of the record descriptions.

- **Stock in/out record**

This record type is more of a reference record than a transaction type. Each record is generated by the system automatically upon either allocation or order entry. The user may manually enter his own in/out records but should do so only



for the purposes of entering, say, returned goods, free samples, or damaged items and so on. The contents of each record are as follows;
Date — the date the movement was added to the file.
Reference — used to record either the order number or allocation number of the transaction, depending on the type, and must be present.
Quantity in/out — the in- or out-transferred quantity.

- **Allocation record**

This record holds details of the outgoing transactions and pre-allocation of stock to future requirements or customer orders, and contains;
Date required — the date the stock will be

needed for despatch and must be present.
Reference — normally used for the invoice number and like the order reference, is only five characters' maximum.
Quantity allocation — records the number of stock items to be held for each sale. This field must be filled. If an entry is made on the same day of despatch, the next field must be entered.
Number sent — contains the amount despatched and the record will remain on the system through a month-end routine if the quantity is less than the allocation figure.

The method of operation of the anagram stock control system is based on a series of screen formats. To be precise, there are no less than 73 screen formats used by the package, each one having a different function or displaying different data.

In addition to that, there is a highly-comprehensive help facility for each screen which the user may access by pressing a key to be shown his options for the particular screen display.

That means there are also 73 help screen formats which fortunately have a standard form which makes their use simple and easy to grasp. Each screen format uses the bottom line to display two kinds of message.

The left-hand side of the bottom line contains the system message line and the right-hand side the error message line. Each message line has a pre-set repertoire of warnings and messages which are well documented and very useful in the course of processing.

Although exceedingly clever in the use of the screen for information display and data entry, we did not feel that the graphics had been put to best use and the formats had a somewhat utility feel about them. Nevertheless all relevant data is displayed and identifiable on inspection.

In line with the screen format philosophy, Anagram has instituted the program-function-key method combined with cursor function selection as the means for the user to work through a hierarchical tree structure of processing.

Numeric keys

Each of the numeric keys on the keypad acts as a program function key when used in conjunction with the shift key. The function of each key is displayed within the help screen and options such as;

PF9 — end processing and return to main menu
PF8 — end processing and return to previous screen
PF2 — display next page
PF1 — display previous page
etc — Transaction options such add,
etc — alter, delete

Where a screen is not a data entry screen or data display, sub-menu options are displayed in the form of a series of choices against which the user may cursor to and hit return to select. Of the multitude of screens, they were either data display formats which were used for data entry as required or menu and sub-menu displays.

The manual gives a good deal of detail on how the user should set-up his system and on the constraints of having a one or two diskette-based file or even a multi-diskette system.

A two-drive system will support from 700 to 850 stock items. Stock-file initialisation is provided as a routine within the package and the only dirty hands exercise the user must undertake is the "newing" of a disc — a simple function available within a Commodore utility program supplied with all of its disc-based systems.

There is also a useful section on converting to the stock-control system which prompts the user into considering factors such as which of the main stock record

(continued on next page)

(continued from previous page)

fields to use, whether to use the allocation or supplier records and if so, for all items or just some, and so on.

The commonsense approach is refreshing in a microcomputer package — the fact that you are considering using a package, i.e., a pre-set method of operation, should imply to every user that you will have to tailor your operating methods to it.

Having set-up our file, we entered the system date which is a prerequisite to entering the package. A display of the current month is given and the last date of

processing also, therefore our entry had to be between that last shown and the month-end. Once the main menu is displayed, the following functions are available;

1. Stock enquiry
2. Stock item processing
3. Order processing
4. Stock in/out processing
5. Stock allocation processing
6. Supplier processing
7. General processing
8. Report printing
9. File maintenance

Each option leads the user to a sub-menu giving further processing options. Functions 2 to 5 are a simple add, alter and delete against an entry of a stock item reference. The supplier processing option is similar but includes an enquiry facility.

The most powerful facility in the package is the first option — stock enquiry. When the user selects this item, he is given the choice of either entering a stock item reference and going straight to the stock item record display or producing an index displaying all stock items in terms of reference, description, and a level flag if above or below the prescribed limits.

There can be several pages of index which is displayed in sorted ascending sequence which may be stepped-through using the program-function keys. Alternatively, the user may enter a reference or search letter prior to requesting an index list which will display the index from that point onwards.

That would prove very useful where the full stock reference is not known or is mis-keyed. Once displayed, the index page may be cursored-through to select the item for enquiry. That achieves the same result as entering the item reference and moving straight to the item display.

The item display consists of three pages showing all the details described in the main stock-record summary. By displaying the associated help screen format, the user is given further options of altering the item details or enquiring into orders, allocations, or in/out movements.

If alterations are required, the screen display returns and shows the current entries in each field with a space underneath to enter new details. Fields are not altered unless addressed with the cursor and data entered.

If further enquiry is selected, the display changes to show all existing transactions of the type selected with dates, reference, and quantities.

Each transaction may be cursored and selected to produce a detail screen of the data. That path may be followed for each of the three transactions types mentioned above. The impressive aspect of the search facility is that at each level, the user is given the option through the program function keys to proceed further, step back and then on the detail level add, alter or delete the transaction or record.

That means that an operator has little difficulty in finding interactively, say, a long-outstanding order against which a balancing partial delivery has been made. He can then proceed to complete the entry without having to return to the main menu and selecting the order-processing function, etc.

Where several pages of information exist, say, of orders, allocations, stock index items or movements, they are displayed in date order, alpha order for items and may be cursor-selected or stepped-through by page.

Order functions

The order, allocation and in/out processing functions available through the main menu are more simple facilities for the addition, deletion or altering of those entry types. Where the need to delete or alter is selected, the appropriate transactions are displayed for the stock item entered and the cursor-select function is again used to narrow the search.

New entries of transactions are all data-validated wherever possible including date check, supplier-number-existence check, alpha-numeric check, decimal point and number of positions, and stock-quantity check.

All transactions are item-orientated, i.e., the item is specified by reference first and then each transaction entered thereafter is posted against that item. Balancing transactions such as orders placed and goods delivered in full are always held on file and displayed until the month-end or condense functions are run.

The data-entry-validation and verification routines are of an extremely high standard and are transparent to the user until an error is made. Some of the error messages associated with each facility are listed to show the nature of the check:

Stock item processing
'Item already on file'
'Min/max inconsistant'
'VAT rate invalid'
'Supplier not on file'
'Item refs inconsistant'

Altering an order
as per order processing plus
'Order date < original'
'Recd. date absent'
'Negative stock error'
'Date reqd. < today's date'

Order processing
'Supplier not on file'
'Received date absent'
'Order date < system date'
'Order date > date received'
'Order date > today's date'
'Date due < today's date'
Date Recd > today's date'
'Zero amount invalid'

Stock movement
'IN/out inconsistant'
'plus above'

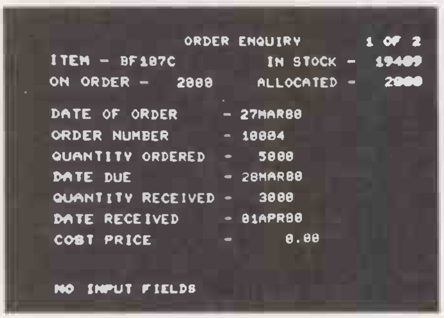
Deletions of any transaction cannot occur unless the transaction is self-balancing, i.e., 1,000 items ordered and received or cancelled. Stock items must be zero with no outstanding transactions against it for removal to be processed.

The header of most of the display formats for the transactions includes fields showing the total in stock, total allocated, and total on order with a reverse highlight where the stock level has exceeded the defined limits on the main stock record.

Stock levels

That is useful as a quick look at the stock situation before entering a transaction which may not be accepted because of levels. Although not a major criticism, we felt that there should be some warning to the operator when an allocation is made which exceeds the total of the stock on order plus the current stock.

The supplier processing is a comparatively simple function which allows the



user to add, alter, and delete the supplier records. The general-processing function permits the user to modify the VAT rates held.

The report printing is routine which offers the following options:

1. Stock cards
2. Stock level highlights
3. Stock valuation
4. Outstanding orders
5. Inactive stock list
6. List of suppliers

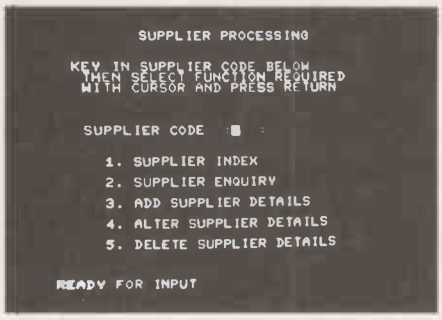
Except for the second option, the user may define either the whole file or part of the file. The part selection is based either on date activity, i.e., in a range, or in the case of items, in a range of references and then on activity or all.

The stock cards are the most detailed of reports and show for each item the full main stock record details and a series of chronological listings of the order history, in/out history, and allocation history with a running balance on the in/out analysis.

Each of the reports is headed by a title page which is also used for alignment purposes. The reports were titled neatly and dated with a print of the various options and selection criteria for the report.

The page formatting was as neat and consistent as the screen displays with full page control, under program control, and page numbering.

Again the sophisticated level of programming in machine code emerged when



we tried a routine which normally works. In the course of reviewing a package and its reports, it is often revealing to unplug the printer to avoid, say, month-end reports, etc., being printed in the course of simulating a year's worth of processing.

Printer disconnection

The programs usually tick away oblivious of the fact that the printer is disconnected. In this case, the screen announced that the printer was not ready and that we could return to the menu by pressing return.

The printer disconnection can be carried-out usually after printing has begun, after the program has checked the printer's existence. In this case, the program detected its absense and aborted the print run, even in the middle of the report.

The stock-level-highlights report produces a summary of stock items in default of the minimum and maximum values set on the master record, giving; reference, bin number, minimum level, maximum level, and in-stock figures.

The stock valuation report is again a simple report which calculates the cost and retail stock values for the selected items and prints; reference, quantity, cost price, retail price or value and totalises the two momentary columns.

The manual makes the proviso that the cost price used for the calculation is that held on the master record and not that held for each item on the respective orders.

The outstanding-orders report produces a summary of; reference, supplier, order number, date of order, date due, quantity ordered, and quantity outstanding. The inactive stock list reports on each selected stock item where there has been no activity since a selected date.

Cost is again calculated using the single value on the main stock record. Included in the tabular summary is reference, in stock, cost price, last-activity date, description.

Finally, the suppliers' list produces a name and address list by code number and it appears label stationery could be used to pick up the boxed name and address format.

File maintenance

The last function available from the main menu is the file-maintenance facility which has the following sub-options;

- File usage — this produces a displayed summary of the disc space availability and usage. Those figures are expressed in blocks and Anagram gives the user a rough-and-ready guide to the storage use of each record type.
- Start of month processing — removes any order record that is no longer outstanding, removes any allocation record whose items have been despatched and calculates a balance of items in stock and replaces all balancing stock movement records with a single balance brought-forward figure record. That clears the file of completed transactions ready for the next month of processing and increments the processing month forward to the next period.
- Re-build index — that is an error-recovery facility intended to be used, say, after a power or system loss. It re-builds the index from the data file.
- Condense file — this has the same operation as the month-start routine but does not increment the processing month. Supplied primarily to clear balancing transactions in the event that the disc becomes full in the course of processing before the month-end.

Good documentation

The standard of the documentation supplied was high with a regard for the first-time user. The record structure may seem slightly confusing initially but all becomes clear after use and a re-read. As an indication of the awareness of the problems likely to be encountered by the user, the contents give:

1. Description of the stock-control system
2. Record structure and contents
3. Operating environment and system attributes
4. Starting the stock control system
5. Stock enquiry
6. Stock-item processing
7. Order processing
8. Stock-in/out processing
9. Stock-allocation processing
10. Supplier processing
11. General processing
12. Report printing
13. File maintenance
14. Initial file set-up and creation
15. Converting to the stock control system
16. Important points about the stock control system
17. List of display screens

The manual covers comprehensively all aspects of running the system including security and deals with the processing in exactly the order the user is likely to encounter each function.

As with any commerical package running on a micro, there are, of course, the limitations of speed of processing and system capacity and Anagram has not unfortunately solved either.

Most certainly the speed of screen processing on data input and verification is very good and fortifies the use of machine code as the driving mechanism, but as soon as disc access starts, the limitations of the micro, not the program, become apparent.

Function selection slows the processing — the object module for each routine has to overlaid into memory from the disc. The package may not be ideal where high volumes of keyed data are entered in batches but is perhaps more suitable to a continuous input. The power of the enquiry facilities is highly commendable and should prevent many likely errors creeping into the stock system.

Minor disadvantages

The package would be suited perhaps to a middle man buying, storing, and selling rather than to the manufacturing world as there is no differentiation in levels of stock, i.e., raw materials, sub-assemblies, and finished goods.

The disadvantages are minor but include half pennies not being permitted, data take-on routines return the user to the menu rather than allowing further entries to be made without selection; program function keys are ineffective while the help screen is displayed.

Data validation

The advantages included a very high level of data validation and checking, commas and colons can be used in addresses and data fields, the package is highly user-friendly with messages stating what activity is occurring and comprehensive error messages. Indices and reports are all sorted into natural sequence automatically without user intervention, listings and reports are labelled and dated clearly and total system security is good and bomb-proof with a clearly-defined exit.

Conclusions

- **The system is a superb piece of programming on a par with VisiCalc.**
- **It is suitable for use with low-volume, high-detail stock applications.**
- **It is very user-friendly.**
- **Mastering the package may take longer than other packages.**
- **It is perhaps not suited to batch keying of transaction data.**
- **The hierarchical enquiry and search makes operation simple.**
- **The program, system and data security is very good, even idiot proof.**
- **Reporting is clear, concise and simple.**
- **As a complete package, it is hard to criticise but it may not be applicable to all businesses.**

Naspen offers word processing at attractively low cost

A 2K word processor running with between 16 and 60K of RAM on a machine for a total cost, including an inexpensive printer, which barely touches £500 sounds a little improbable — especially when that same machine can be used for other low-cost applications including stock control, accounting and research work. Naspen, the word-processing package from Nascom, seems to be the proof that software need not be expensive nor run on super-expensive machines.

IN NASPEN, I found a surprisingly sophisticated writing aid capable of important time savings. Despite the fact that I earn most of my living bent double over a tolerably co-operative electric typewriter, I somehow never really progressed much beyond the two-finger stage. As a result of that inadequacy, I seem to spend a disproportionate amount of my time typing, copying, re-tying and re-copying draft copies.

Naspen is available in two forms: one for the old Nasbug T-4 and B-Bug operating systems and one for the newer, and far more elegant, Nas-Sys system. It is available only in EPROMs.

On executing a cold-start one is greeted with the message:

NASPEN VS.1 LINE 1 12000 FREE

at the top of the screen and a mysterious semicolon at the bottom-left-hand corner. A good time to resort to the manual since anything I did at the keyboard simply produced the not-a-valid-command message.

Information manual

Nowhere in the manual was there anything to explain how to start entering text. There were instructions for appending text, instructions for inserting text and instructions for all the other clever facilities, but nothing on how to get underway.

The answer is, in fact, simple: enter 'A' for Append — even though there is nothing to which to append. In fact, despite the manual's confusing form, the information is there and Naspen is so easy to operate that a day or two of familiarisation is all that is required.

The rest of the package is good enough to justify both the price — £30 or thereabouts, depending on supplier and VAT — and the title word processor.

On initialisation, Naspen is placed in the command mode automatically ready to receive instructions for its next step. The semicolon prompt accepts a command, holds it on screen during execution, and scrolls it up a line on completion. That is particularly useful during long insertions, printing or formatting when the screen freezes without giving any indication of what is going on where and the only indication of life is on the two command lines.

On entering the letter 'A', no enter or new line required, text is accepted as typed until the escape, shift and new line on the old keyboards is pressed.

As a first step towards editing that crudeness, the text and cursor are zeroed, enter Z, and the command L tells Naspen to adjust the end of lines to match the natural word breaks.

No additional spacing, justifying or paginating at this stage — just readable copy. It is now possible, using various command keystrokes, to correct spelling mistakes, 'c' followed by a letter changes

by Nick Laurie

the character at the cursor to the new one, insert spaces, paragraphs, or individual letters and to delete letters, lines but not, unfortunately, whole blocks.

Thanks to an auto repeat, the cursor can be moved round the text, both on and off screen, at high speed in either single steps, 10-space steps or line steps although always to the start of a line in this latter mode. The text can be scrolled through the screen either line by line, again with an auto repeat, or, in definable length page blocks.

The auto repeat is available on all keys and can be a problem when, for example, one has entered a command and kept one's finger on the command key for too long while thinking. The manual says that this can produce undesirable results — an understatement, but no real harm will be done.

Strings of text can be searched for using command 'f' followed by the text required from either the current cursor position or from the top, 'F'. The find mode must be left when corrections or replacements are to be made and can be recalled using 'a' to continue searching.

There is no replace command so that use of find can be tedious at times. No account is taken of the fact that a phrase may have been re-formatted with extra spaces and so that function is best reserved for single words. I found it particularly useful in conjunction with an asterisk marker which can be put anywhere in the text and find is used to return to a place of interest.

Insertion of whole blocks into the body of the text is a simple business. The 'A', append, command is used to create the new text which is bracketed, 7B and 7D Hex; the append mode is left and the cursor is moved to the insertion point where the asterisk and find are useful. The command 'M' is entered and the complete insertion proceeds automatically.

It can be slow for a lengthy insertion at the beginning of a long piece of text as all the remaining text has to be re-calculated and re-positioned continuously — and if you position the cursor incorrectly, as with most block-handling commands, it cannot be interrupted during execution.

Blocks can be deleted but only from the current cursor position to the end of the text buffer, using the 'K' command, kill. That is very sensibly provided with a safety device — the word kill? is displayed on entering a command 'K' and the command will only be executed if a 'Y' is entered. Any other character causes the command to be abandoned.

Sensible precaution

That is a very sensible precaution since the text buffer can comfortably hold a reasonable amount of text and, once killed, only judicious and sympathetic machine-code work can retrieve the text.

Once the text has been edited to place the correct words in the proper places in a readable form, the processor has already justified its existence in time savings alone.

Everything up to this point will have been formatted to fit your monitor screen and this is a good point at which to put it on to tape for simple storage. Here, again, there are limitations. Files cannot be stored or retrieved by name — an unforgivable error in my view. On loading or joining — the addition of taped material to a partly-filled buffer of text — the taped file is loaded to the start of the text area automatically, pushing any existing text towards the end of the buffer.

All in all that makes for inefficient use of tapes since, at 1,200 baud, even a very short tape can hold a good deal more than the 12,000 characters of a full Naspen.

Use of a tape counter helps, but adds complication to what ought, surely, to be one of the main features of any word processor. That again is an area which could be improved. Nevertheless, the ability to store and retrieve raw material is an essential feature of any word processor and Naspen scores marks, if not full marks, for possessing that ability at all.

Once an article, letter or whatever has been written and edited, true formatting for output to a printer or typewriter is possible. While that formatting is limited effectively to justifcation at both margins by insertion of full character spaces, it creates very neat and tidy output.

The 'S' command is entered and spaces are inserted between words automatically up to a maximum of one space added to each existing word space and starting from alternate ends of alternate lines, until the line reaches the required width.

Double spaces in the original are treated as words so that tabbing will not be re-formatted, but new lines and spaces are treated as interchangeable so paragraphs need to be separated by a double new line if they are to be retained. The required width is, by default, 72, but a single keystroke displays the current length and increments or decrements the value to any required setting using an auto-repeat to count up or down.

Auto-repeat rate

That auto-repeat rate, incidentally, is the same rate for cursor flashing, counting up and down, page or line scrolling and for everything else on auto-repeat — a compromise for economy's sake which could also bear revision at enhancement time.

Whenever there are insufficient word spaces to allow full justification, a message is displayed to that effect and an extra word is tagged on to the displayed line in question with the cursor pointing to a suggested hyphenating point. Unfortunately, hyphenation at the indicated point does not work — it is necessary to return at least one character space from the cursor to access the line — an unnecessary error.

Once the hyphen and a space to simulate a word break have been inserted, the cursor is sent to the start of the line in question and entry of an 's' command continues justification from that point.

Space correction

Should you find that you have accidentally formatted everything to 41 characters per line for use on your 40 cpl printer, all the inserted spaces can be deleted using an 'X' command. The find is then used to track down all your hyphen/space combinations which can then be deleted and you start again with the correct line length.

A page-terminator symbol can be entered using a single command and this symbol reproduces itself on the end of every page as set by the page length — number of lines — command. Default is 68, reasonable for single-spaced A4 but changed easily as for line lengths. That terminator suspends printing under Naspen to allow insertion of a new sheet of paper or, if you happen to have a machine with changeable type heads, the page-terminator symbol entered through the keyboard can be used to hold things while you change to an italic or bold typeface.

If you plan to use a print terminator regularly for type changes, it might be worth changing the symbol used since all (07 Hex) are cleared automatically during any major formatting commands. Instructions are given in the manual for doing that.

An 'N' returns control to the operating system; an eight-space tab function is available, unchangeable, and a host of other minor controls are all shown in the accompanying table.

Among the weaknesses there are one or two I find irritating and, I suspect, unnecessary. The top line space holding the message Naspen VS. 1 and so on could be occupied far more usefully displaying information on current line and page lengths, cursor position across a line and even for holding the command lines.

That last change would leave two more free lines on-screen for text — an important consideration since the Nascom system displays only 15 lines of 48 characters at best.

My biggest moan of all is about the cursor — a flashing back arrow which sometimes refers to the position on which it is placed, sometimes to the preceding position and, in the case of hyphenating, to a point two character spaces away. All that according to the mode in use at the time.

Conclusions

- **A basic but functional word-processing system, operating within the limitations one could expect from an item of this size and price.**
- **In conjunction with an existing support system, it enables the simple production of articles up to about 3,000 words after which the limited mass storage may become unwieldy.**
- **It is simple to use, once mastered, and will find many applications in laboratories and home environments where Nascom is already common.**
- **An enhanced version would overcome many of the irritating quirks of the £30 program but, even in its current form, it is a very useful tool and a good introduction to word processors.**

Table 1. Main features of Naspen.

Primary input commands	
A & I	Allow text to be appended or inserted in a raw form with normal use of all keyboard functions, an auto-repeat function and an inbuilt eight-space tabulate function.
L	Formats raw text to suit selected line length using natural wordbreaks and then, very irritatingly, ends by returning the screen display to the beginning of the text.
S & s	Right-justify text from, respectively, the start and the current cursor position. No hyphenation is carried-out although some indication of the place where a hyphen might be required is given.
D & d	Delete, respectively, a full line or a single character. Auto repeat on single character only.
c	Changes a character — handy for spelling mistakes.
i	Inserts a single character.
M	Moves a block of text without destroying the original to the position indicated by the cursor.
K & Y	Kills all text from the cursor position. This command is protected and requires an answer-back (Y) before execution.
F, f & a	Find a selected string from, respectively, the top of the buffer and the current cursor position. Pressing new line finds the next occurrence as long as you have not left the find mode or, after making an alteration, 'a' will find the next occurrence of the last defined string from the current cursor position.
Printing commands	
C	Clears any previous page end markers and/or print terminators.
G	Inserts a page terminator (ASCII BEL) at pre-determined intervals from the current cursor position. A single BEL can be inserted in the text using 'i @ /G' — insert control G — and will stop the printer when encountered.
P	Outputs to a printer from the current cursor position to the next occurrence of a page or print terminator or to the end of the text if command 'C' has been used. Normally points to XOUT or SRLX routines in the operating system, but those reflections can be altered to suit the user's print routine.
Tape Routines	
	They are designed for a cassette system such as is probably already in use with most Nascom systems. No support of discs, named files is built into Naspen.
W	Writes the entire text to tape using the normal Nascom write format.
V	Is used to verify correct loading of a type by using the verify routine in the operating system.
R	Reads a tape into the text buffer, overwriting any existing text.
J	Reads a tape into the text buffer pushing existing text up the memory until, if overdone, it overflows and is lost.
Miscellaneous commands	
N	Returns control to the operating system.
X	Removes all extra spaces added during 'S' formatting. Always check that it has behaved after use. Page symbols are deleted.
H	Homes the cursor on screen.
Z	Homes cursor on screen and displays text from the start.
	Other commands enable the cursor and text to be moved in and out of the screen area in steps of varying lengths from single space to a page at a time. Line length, page length, auto-repeat rate are user-adjustable.

Exorset development system is ideal for high-precision work

THE EXORSET 30 is a development system and is, therefore, aimed at a scientific or engineering market rather than the business user. As the name for this generic family of computers suggests, devices which fall into the category are used as tools rather than ends in themselves.

They are used to develop prototype programs which, at a later date, may be burned into read-only memories to control dedicated microprocessor applications — frequently in the field of process control.

Control device

A development system has to emulate the microprocessor which will be used as the control device in the final application and for that reason must have plenty of hardware access to and from the outside world so that the emulator can be hooked into the system the end product is likely to control.

Apart from that rather special ability to provide a high degree of hardware interfacing, one should still expect many of the features which are considered essential for business purposes although the software might have special features to cope with its specialised applications.

The system looks like many up-market micros. A single cabinet contains a nine in. monitor screen, two five-in. floppy disc drives and a conventional QWERTY keyboard. The keyboard sports an extra bank of 16 keys named F1 to F16.

We also received two floppies containing the disc operating system (XDOS), the Motorola Basic written specially for the Exorset 30 and named Basicm — an editor and an assembler plus five manuals.

The first 16 pages of the users' guide gave a very detailed specification of the hardware followed by 26 pages describing how to install and start the system; this section also described the 86-line extension busbar and the multitude of I/O connections.

On checking that against the reality inside the cabinet, we found that most of the system is contained on a single board measuring 248 x 504mm. which has three on-board sockets to accept extra cards.

The VDU is a more or less self-contained unit very adequately screened from the rest of the system. The whole thing was powered by a very impressive looking power supply which was fan-cooled — eventually we found the fan to be somewhat noisy.

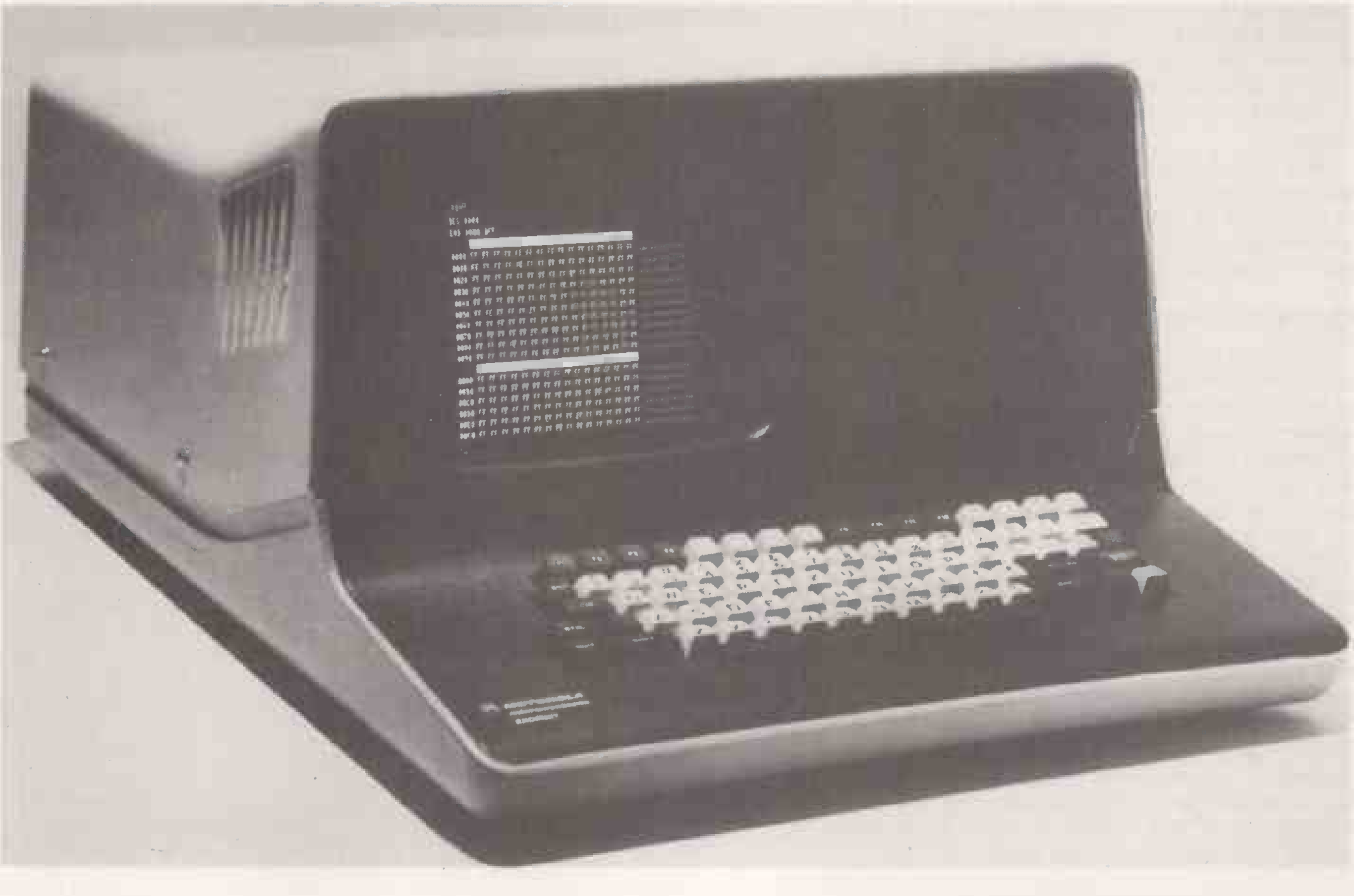
The main board contains up to 32K of RAM and up to 24K of ROM or EPROM can be inserted as well as the RAM. The CPU is the MC-6809 and the system supports RS232 I/O, input and output interface to a cassette tape recorder, the internal VDU or, as an option, a modulated video output to a conventional television set.

Internal keyboard

The internal keyboard is, of course, also supported by the main system. On top of it are edge connectors carrying further parallel and serial interfaces to the outside world.

The master clock cycle is one microsecond and various baud rates from 110 to 2,400 can be selected. There is an incredible number of jumper options on the main board which offer choices of UHF modulation polarity, ACIA and PIA interrupt destinations, graphics RAM-base addresses, initialisation conditions for the type of display 40 or 80 characters per line.

Other options include 50Hz or 60Hz



operation and which of the two possible memory-mapped configurations are required, keyboard language type — English, Spanish, German, Swedish, Norwegian, Danish and French are all catered for.

This list names but just a few and we were very glad to see that the system, as supplied, is set up to a default option which accepts English at 50Hz and seemed to communicate with everything we tried in a sensible manner.

The disc control card contained a further 16K of RAM and 1K of disc driver held in ROM. That supported two BASF 6106 disc drives which use single-sided, soft-sectored discs having 80 kilobytes of storage capacity per disc — 40 tracks, 16 sectors/track and 128 bytes per sector.

At long last, having waded through all the material given in incredible detail, we arrived at the section on switching on. That proved to be remarkably simple, flip the switch; wait for the VDU to warm-up; adjust the brightness and the monitor (EXORbug) announces itself.

That is a 4K monitor with 72 options for the user through the keyboard. They cover almost any eventuality one could ever require: dumps to screen or to tape; input from tape; verify input from tape against data in memory; jump to XDOS; display register values with options to change; move memory blocks; set and remove break points; trace operations; write and run machine-code programs; plus many other programming and debugging aids.

Software toggle

Apart from those, there is a set of special control functions which control the hardware. The background shade of the screen can be reversed from dark to light by means of a software toggle and, likewise, the display format can be changed from 80, normal, to 40 characters per line and the graphics display can be toggled on or off as can the alpha-numeric display.

The latter feature is interesting because normal alpha-numeric characters for the display are held in one area of RAM while the high-resolution graphics RAM is a separate area of memory.

The two displays can be superimposed, one upon the other, with the alpha-numerics brightened on a bright graphics background. One display could be modified without affecting the other.

Once we had discovered the operating instructions for the monitor, we found it extremely well documented and extremely easy to use. Our only criticism was that this important section of the documentation was rather hidden in the middle of a thick manual. It would have been useful to have had this 36-page section as a separate booklet for ease of reference.

Another interesting monitor instruction was TMAP and it was not until we read the next 40 pages or so that we found its significance — it changes the memory map configuration of the system. That allows the user to opt for either a good deal of extra RAM or use 24K of ROM in its place.

The RAM and ROM can be resident at the same time and one map or the other can be selected through software. There is much in common between the two maps, e.g., the bottom 32K is RAM in either case and the top 8K is dedicated to the system and contains the monitor (FOOOH upwards) and a RAM area from EOOOH to E7FFH to hold the alpha-numeric display and scratch pad areas.

Other addresses in the top region are used for I/O and disc control. It is the region between 8000H and DFFFH which can be re-configured as an extra 16K of RAM plus 8K of ROM (option 1) or as 24K of ROM (option 2).

All the RAM used in the system is dynamic and that is time division multiplexed between the VDU controller and CPU. It means that it is constantly being refreshed within 512 microseconds. The VDU control chip also generates addresses to the block of 16K sitting between 4000H and 7FFFH which may be used as the high-resolution graphics display.

Background

Motorola started life in the early thirties as a manufacturer of some of the first car radios. Today, the corporation is multinational in scope and employs some 50,000 people in 35 countries with sales approaching $2.8 billion in 1979. In integrated circuits, Motorola has gradually increased its share of the world market, with popular products such as the 6800 range of processors, rising from fourth position in 1977 to third in 1979. The semiconductor group has had plants in Europe since the early 1960s including one of its key development centres, in France, for discrete and linear integrated circuits. Its plant in East Kilbride, in Scotland, serves as the European source of advanced MIS products. In the U.K., Motorola is based in York House, Empire Way, Wembley, Middlesex.

The bit pattern in each byte defines the picture-point positions across approximately one-eighth in. along a single raster line on the display. Careful control of the bit patterns produces extremely high-resolution and fine line displays but it takes a good deal of programming effort to do it.

We found that it was very easy to run into that 16K block accidentally with program data and which, of course, completely ruins any picture one had built-up. It turned out to be a particularly frustrating problem when using Basicm because, whatever we tried to do, Basicm grabbed this area and overwrote it.

After playing with the monitor, we found another feature of the machine — an audible warning of an erroneous entry. For such a sophisticated piece of equipment, one had to smile at the rather half-hearted and strangled squark from the alarm — nonetheless, it serves its purpose adequately even though it draws not only the user's attention to the error but everyone else's as well.

The tape I/O operates at approximately 1,333 baud and the principle is based on two periods, one millisecond for "1" and 0.5 millisecond for "0". The phasing of the tape recorder has to be considered and there is an on-board jumper which allows the user to compensate if his tape recorder introduces 180° phase shift between recorded and played-back data.

To progress beyond the monitor, it is necessary to invoke the disc operating system. That proved very straightforward; simply slot the system disc into the first drive; type XDOS on the keyboard which, is recognised by the monitor, press return and XDOS displays its successful load.

As one might expect, the XDOS manual was the thickest of all and literally packed with information. Again, the quantity of explanatory material nearly defeated its own purpose and it took some time to grow accustomed to the system commands.

To escape from an XDOS command, we initially used the break key which proved most frustrating because it returned into the monitor and entailed re-loading the system each time. Eventually we found that CNT P would have broken into the command mode of XDOS.

Our initial attempts to operate XDOS quickly drew our attention to the delete key which, considering the system uses a VDU, could have been made easier to use. Instead of back-spacing the cursor and erasing the last character, it repeated the previously-typed characters in reverse order until the character which had to be changed was reached.

For example; to change a mistyped entry BUSICM to the form required, BASICM, would produce the following display: BUSICMMCISUASICM. Of course, that would be needed if a printer was used but it would have been vastly preferable to have a neater method on screen.

Tape phasing

Until we became used to the syntax of the XDOS commands, we frequently encountered the error message WHAT? While that kind of message might be tolerated from a firmware monitor, we felt that rather more useful and explicit error messages ought to be issued from a disc operating system.

One of the first commands we explored was DIR; this displayed the diskette directory. In its simplest form, it displayed the directory entries of just the user's own files but by invoking various options, displays of the system entries could be obtained.

One of the useful features of DIR was the ability to display family or generic names. That enabled a search and display of a particular entry or family of entries.

Before a new disc can be used, it has to be formatted with the format command. Once it has been done, a system can be

(continued on next page)

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created on disc using either the DOSGEN or BACKUP commands. BACKUP enables the user not only to make a backing copy of a disc but also to re-organise and create selectively the new system.

Once a disc has been formatted and a system installed on it, the user has a variety of commands within XDOS to maintain the files. Those commands include copy, to copy files; name to re-name disc sectors for examination and LOAD will enter any program from disc ready for execution.

We next tried the XDOS editor by loading it from disc. At first glance, it looked rather disappointing — probably because its manual was the thinest of all, only 16 pages, and we had already become acclimatised to the weighty nature of the Motorola documentation. In fact, we were wrong and the editor proved very good and bore a great similarity to the TSO editor of IBM mainframes.

The editor operates line by line and is not a full screen editor. The user can build new files, list the file being edited, load a file from disc and SAVE a file to disc. The build, load and save commands enables the user to specify file names and to direct which of the two disc drives should be invoked.

File editing

List would display all or part of the file being edited by the line number and normal editing is done by specifying the line number in question. Lines could be inserted, replaced or deleted.

Further options allow ranges of lines to be duplicated or shifted within the file by using the duplicate or move commands. A very useful feature is the change command which allows a search for and a change of a string of characters over a range of line numbers.

Verify causes each line which is changed to be listed and find will locate a character string over a range of lines.

The merge command proved very difficult to use until we discovered that its description was wrong; when we found the proper way to use it, we were able to load a range of lines from another file and insert them into the file being edited very useful.

Our only gripe about the editor was the lack of a TAB command which made the preparation of neat assembler rather tedious.

The disc Basicm was, as we had come to expect, very well documented. In most respects, it resembles standard Basic but incorporates many special statements which have been designed for use in process control and real-time applications.

It is classified as a Compiler/Interpreter and superficially is used much like any other Basic. As statements are entered, they are compiled into a condensed form of re-locatable code ready for execution by a run-time library. A great point is made that the run-time library is also relocatable.

The importance of that is linked to the Exorset being a development system. It means that one can, in theory anyway, develop process-control programs in the relatively simple language of Basic and transfer the compiled code neatly compacted into a PROM which can then be plugged into the control system.

That, however, pre-supposes that the user also has a copy of the run-time library also residing in the ROM of the control system. Being re-locatable, that would greatly simplify the transposition from development system to actual system.

The only problem we see is the large amount of ROM the control system would have to provide to hold the run-time library — that might be many times larger than the program it was to interpret.

Relative merits

The relative merits of using memory-intensive Basic and slicker and faster assembler in process control is arguable but there is no doubt that Basicm would allow faster program development.

Some of the unusual statements of Basicm include real, string, byte, when and on. On is used in a different context from that found in normal Basics. Within the Exorset, it is an interrupt statement linked to the 16 special keys on the front panel.

```
ON KEY 16 THEN BOSUB 1000
```

causes the subroutine at line 1000 to be called if the key F16 is depressed.

The same type of statement could direct operation to other subroutines whenever other of the special keys were depressed. We found, however, that those interrupts could not be nested one within the other.

At the end of the interrupt called subroutine, the program returns to the next line of Basic in the same manner as if the on-key statement had been a straightforward gosub.

The when statement is very interesting as it causes the interpreter to check the condition of the line, on which it occurs, continuously during the running of a program.

The manual states that great attention has been given to speeding the arithmetic routines and, certainly, we found them fast but, conversely, we found that string handling was generally rather slow.

We have already mentioned the high-resolution graphics display within Exorset hardware and we were most surprised to find that there were no plot commands within Basicm. It would have been very advantageous to make use of a vectored-graphics facility through Basic — it is rather complex through assembler. Basicm has, however, a poke statement, so a quick program was written to try and make use of this tempting piece of hardware.

We typed run and slowly the graphics appeared, then suddenly the whole system went down and we had to re-load from scratch. By chance we re-loaded the Basicm with the high-resolution display option on and noticed that as Basicm was being loaded, the screen took up a random pattern — Basicm was being loaded into the VDU high-resolution RAM area.

As that was the top of RAM, we assumed that it was the run-time library occupying the area so, not to be defeated, we went back to the manual which says quite clearly that the run-time library can be relocated to any position in memory — but where was the run-time library? This important piece of information was missing. Eventually, after a telephone call to Celdis, the missing piece of documentation was found — on a disc file.

We now thought we were well on the way to success but, unfortunately, no easy way could be found to move both the Basic program and the run-time library to free the graphics RAM area.

During that exercise, we found several other problems with the compiler. It was not possible to specify the start location of the generated code and, if the variable and array locations were moved, the compiler would not notice if they overlayed the program.

We also found two bugs; the statement BYTE V(246,40) occupied all the memory and caused the most weird error messages. Furthermore, in a deliberate attempt to invoke an error message, we entered the statement DIM A(8000) — knowing full well that there would be no space for an array of this size — and the system crashed in a most dramatic way.

The screen went completely blank and the strangled squark of the audible alarm produced the most intense and penetrating continuous howl we had heard from it.

The assembler proved to be nothing special.

Conclusions

- **In hardware terms, it was excellent, offering tremendous versatility while, at the same time, being very simple to operate.**
- **It is a tool for the technically-minded and the normal business user is not likely to make use of all its facilities — Motorola has other machines in the range for them.**
- **Its monitor is first class, simple to use, and relatively straightforward to understand with a vast repertoire of commands.**
- **The concept of Basicm is fascinating but there still seems to be some work in perfecting it.**
- **To meet the requirements of the sophisticated development engineer, Motorola should accelerate the production of their macro assembler.**
- **The hardware is so good, it warrants something better than that which is currently available.**
- **Documentation is excellent in its detail and a system such as this really needs to be described fully.**

Challenger interfaces make it a top choice for general use

DURING the past few months, a very interesting machine offering numerous facilities, including colour graphics, high-speed Basic and a whole host of interfaces has been advertised widely in U.S. micro magazines. The machine, is the Ohio Scientific Challenger C4P.

Ohio Scientific produces the very successful Superboard II and the C4P may be its challenge for the Apple II market. The specifications in the advertisements and the very competitive price certainly support that view.

Mutek in Wiltshire supplied the test kit, which was the Challenger C4P-MF. It is a keyboard computer with 53 keys in the QWERTY lay-out and is boxed in a pressed-metal casing with two teak-like wooden side panels. The packaging is efficient and reasonably attractive.

True potential

The MF designation means that it is a mini-floppy disc system. The single drive was in a similar pressed-metal casing with wooden side panels and stacks neatly on top of the computer. It is not until one looks at the back of the computer that the true potential of the machine becomes evident.

There are no less than nine multi-pinned connector sockets and six phonotype sockets. They allow interfacing to various peripherals — including most interestingly an AC remote controller and audio interface.

The display was designed by OSI to interface to an U.S. standard video monitor — to display on a domestic U.S. TV requires an RF modulator. Mutek has modified the equipment under test for 50Hz and supplied it with a black and white monitor with an eight-in. diagonal screen.

Since the system was complete and self-contained, to set-up the system all that was required was to plug into the mains — the system as described requires three mains sockets. Other than a search for the

by Vincent Tseng

on/off switch on the monitor, there was no difficulty in setting the system running. For a change, the documentation supplied had the unpacking and setting-up instructions at the front.

On switch-on, the display showed a screenful of random characters, by using the break key, the screen is cleared and H/D/M? is displayed. The response "D" would cause the mini-floppy disc to boot-up, provided a system disc has been inserted in the drive.

As this was the MF version, most of the facilities were contained on disc. The system was not, however, entirely disc-dependent as "M" would call up a very simple machine-code monitor.

The display was capable of showing 64 characters by 32 lines, but the number of columns can be selected by programming a single POKE instruction to decimal address 56832 to be 32 with wider characters.

The Basic on the C4P-MF is disc-resident, with nine-digit accuracy and is written by Microsoft Inc. It has all the expected functions of the usual good versions of Basic. One of the significant claims is the speed of this version.

The benchmark programs confirmed that it ran approximately 15 percent faster on benchmarks one to seven than the Nascom-2 at 4MHz with one-wait state, but was some 35 percent slower on benchmark eight.

It is one of the fastest versions of Basic according to the benchmarks, considering that the 6502 MPU can be upgraded to the 6502C — the GT option with faster memory will run at twice the speed.

Graphics characters

Surprisingly, using the CHR$ function, the Basic can only access about 90 characters from the set — the normal ASC11 characters. The other graphics characters are accessed either by using POKE commands or direct machine code to the video memory.

What appears on first sight to be a bug on returning to Basic from DOS is a deliberate feature which locks-out functions such as Control-C, NEW, LIST, CLEAR so that Basic programs running cannot be interferred with.

Those functions can be put back into operation by POKE commands, but that is not made clear in the documentation. On the configuration under review, the "H" option will not, therefore, have any effect when called-up.

There are two machine-code monitors available. One in ROM, which is the one called by the "M" option after re-setting with the break key. It is very simple and only just adequate.

The disc-resident extended machine-code monitor, however, is a different kettle of fish — it has extensions such as the setting of up to eight breakpoints, disassembling of memory contents, and a particularly useful one of searching memory range for a byte pattern or patterns.

This monitor is almost as good as the excellent AIM-65 monitor, the only features missing are the single-step/trace facility, and it would have been useful to have direct mnemonic entry, direct one-line assembly, to remove the tedium of having to enter in Hex.

All those facilities obviously are disc-resident and, therefore, dependent on the disc operating system — designated as OS-65D V3.O, a very primitive operating system. Although the functions and utilities are there to make the system usable, they are basic.

For example, instead of just saving on the disc by name, the user has to first create that file name and specify the track number and length of the file.

The users' manual, however, gives a good hint for setting-up a temporary working file so that any current work can be saved without having to create.

Disc capacity

The situation is further aggravated by the fact that there is only one disc, and not a very capacious one at that. The mini-floppy records only at single density, which means that the capacity is about 80Kbytes formatted. As the operating system and utility program files already occupy some 32Kbytes, of the disc, one can see little space is left.

Can one not set-up a disc with only the bare essentials to create more space? The single drive makes backing-up and copying of discs very tedious. Mutek can supply a single-drive copy routine with which a disc can be copied, the essential 14K of the operating system, in a matter of minutes with about eight changes of disc. The copy program needed modifying for the test kit to respond correctly to the keyboard.

As mentioned earlier, at the back of the C4P-MF there are numerous connector sockets: two RS232C serial interfaces, one at 300 baud for a modem and the other at 300/1,200 baud for a printer; OSI expansion bus: 16-line parallel I/O interface; two multi-pin connectors for a pair of joystick controls; and outlets are for the video, audio output, eight-bit digital to analogue (DAC), AC remote-control interface, the remaining two are not used for the floppy disc-based systems, but are the cassette connections for the cassette-based version.

The parallel I/O interface has a home security system designed for it, including the software, for fire and burglar alarm/deterrent systems. Audio is achieved by the connection from the audio outlet to a speaker via an audio amplifier. The AC-12P peripheral allows the programming of electrical domestic equipment by the computer.

That is achieved by wireless remote control — the controlling signal is transmitted via the existing home wiring.

Summary specifications

CPU-6502A

Memory — Total including monitor and bootstrap in ROM, 2K video RAM and users RAM = 27.5K bytes' maximum RAM expandable to 48K.

Disc — Single mini-floppy disc drive recording single-density soft-sectored format; approximately 80Kbytes per disc formatted.

Keyboard — 53-key QWERTY lay-out with shift-lock key.

Display — 64 characters x 32 lines, 256 character set, upper- and lower-case plus graphics elements.

Interfaces — Two RS232C, OSI expansion bus, 16-line parallel I/O, two joystick connectors, two keypad connectors, audio outlet, one DAC, AC remote-control outlet.

Price : from Mutek C4P-MF £985.

With the appropriate switches/controllers at the mains sockets, the attached equipment, e.g., lights, radios, etc., can be controlled.

Obviously, one is not restricted to the devices provided by Ohio Scientific — with that many interfaces, the possibilities are enormous for the user to control all kinds of equipment by the computer.

It should be noted that the non-disc version, the plain C4P, lacks a few of the interfaces, but does have the AC control and audio outlets. It is also ROM-based for its operating system and Basic. Therefore, although some of the hardware interfaces may be added, there may be difficulty in conveniently obtaining the operating software which is supplied for the disc-based version.

The C4P is upgradable to the MF version, though, so check carefully with your dealer on the availability of the interfaces/features which are important to you.

The disc system is also supplied with an assembler and editor. Both are rudimentary, but again adequate. The assembler merely translates mnemonics to object code, with the expected error-checking and listing facilities, but does allow labels and symbols.

It is not re-locatable or linkable. The editor only allows entry and scrapping of lines — long lines with mistakes have to be re-entered.

One minor irratation was that the rub-out key was non-operational under all the software systems tested. One had to use shift/O to erase the last character entered on the current line.

There was a substantial documentation file which is, unfortunately, very patchy — in places undeniably good with clear explanations even for the relative beginner, but elsewhere leaves a great deal to be desired.

There were examples which did not work on the test kit. I found the keyboard-control example did not work with the Peek/Poke address given.

The U.K. Ohio Scientific user group publishes a very good/professional newsletter every three to four months. The information contained in the three issues I have seen is invaluable. That, in a way, compensates for documentation which, perhaps, leaves something to be desired.

Conclusions

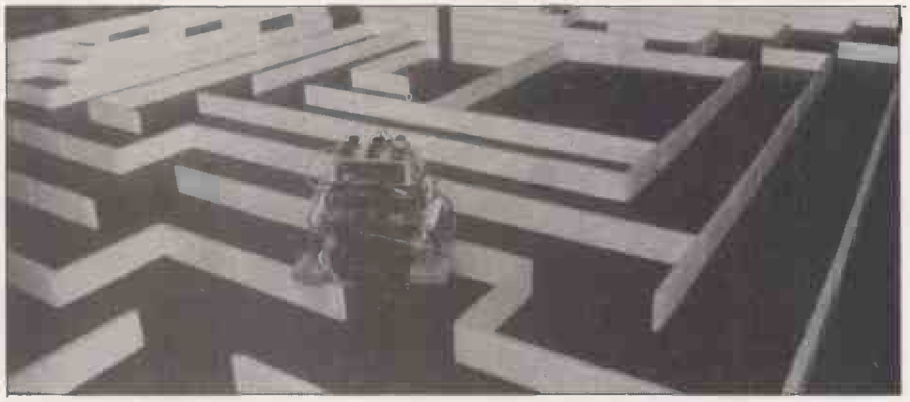
- **I was very impressed with the machine, despite a few shortcomings. It is perhaps not a particularly easy machine to use, but the possibilities offered in terms of interfacing and controlling must make it one of the top choices for business and general use.**
- **Main disappointments are that it has not been converted fully for U.K. colour yet and the C4P version, cassette, lacks a number of attractive features of the MF version.**
- **The documentation would be improved greatly by a thorough re-organisation.**
- **Whatever the extra effort involved, the machine offers extraordinary interfacing possibilities.**
- **Prices are £985 for the C4P-MF, £395 for the C4P which represent good value for money.**

Entrants to Micromouse maze leave the rat-race behind

The first heats of the Micromouse maze contest were held recently at Portsmouth Polytechnic: Martin Hayman reports.

"THERE SEEMS to be some kind of electronic Warfarin going around", joked John Billingsley, a spry and impish character with an astonishing electrified shock of grey hair and twinkling eyes behind pebble glasses. "All the micromice seem to have been dying like flies".

It was true: the turn-out for the initial trial runs of the Amazing Micromouse Contest, held at the Portsmouth Polytechnic's department of electrical and electronic engineering, was slender and, but for the efforts of Billingsley, the event would have seemed almost desultory. He had been on the telephone until late the previous night trying to persuade likely runners to attend in whatever stage of development their mouse might be. It should be seen as a measure of the difficulty of the task rather than a reflection on the enthusiasm of the would-be contestants that only a small proportion of the 70 to 80 entrants were present at Portsmouth. However, I suspect that some of the semi-official or works teams preferred to wait until the official London heats this month before showing their hand, which may prove to be a mistake since at this stage there is very little that can be done to modify a mouse design.



A robot mouse senses its way round one of the corners of the maze.

Testing run

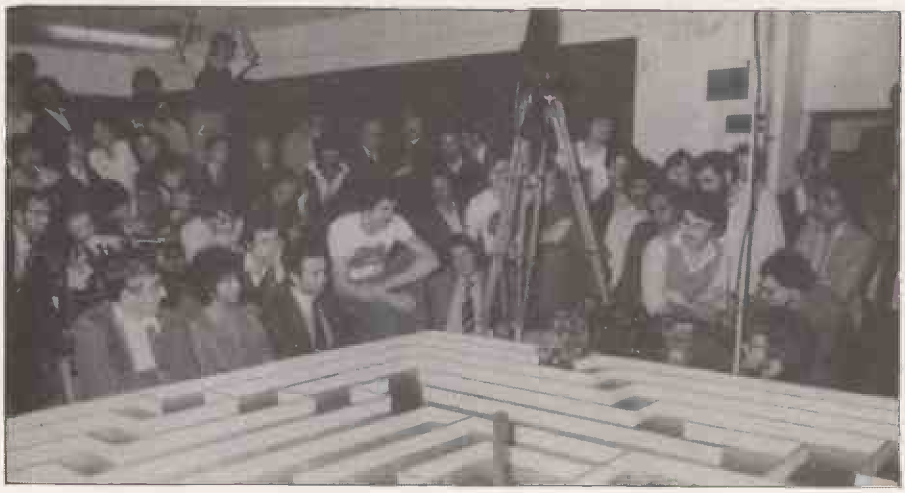
In the event, it was a very testing dry run and if none of the mice succeeded in running the whole maze, it may be seen as confirmation of Rodney Zaks' suspicion that even at the finals, he expects only six mice to succeed. Zaks, incidentally, has declared his intention of being there.

Yet let it be said that there was an atmosphere of an event. A team of observers from Japan's Science Museum had arrived and assiduously snapped each mouse from every conceivable angle.

Intellectual aspect

The museum's Dr Miyamoto revealed that although the ostensible purpose of this kind of competition was fun, he took its intellectual side seriously. He revealed that in Japan, mothers were already buying their children microprocessors, such was the popularity of micro-related activities.

There was also a reporting team from BBC South, whose reporter Tim Hurst cued in the TV slot with a sequence of a clockwork mouse which was immediately dubbed A Nonny. Contestants who noted our observations on artificial lighting, Printout, July, will do well to bear in mind that at least some of the aberrant behaviour on the part of the mice was caused by the intensity of the TV lighting and since BBC *Tomorrow's World* will almost certainly be at the London heats on September 17, proper screening of IR sensors is a must.



Humankind has long had a fascination for mazes and has devoted a remarkable amount of energy and ingenuity to constructing them; from the fabulous maze at the Palace of Knossos in Crete, where the Minotaur lay in wait for Theseus, through the turf mazes of the pre-Christian British with their associations of pagan Maygames, to the medieval mosaics which find their finest expression in Chartres Cathedral, to the comparatively modern box-hedge Tudor mazes such as found at Hampton Court.

Even now, one is being built, or rather grown, at Longleat House, Wiltshire, to a design by a Frenchman which is claimed to be the world's most difficult, so a word on the construction of the maze through which our robotic intelligence must thread its way will not come amiss.

Blockboard base

The maze at Portsmouth is constructed on a blockboard base coated with flat black emulsion. Constructors should bear in mind that chipboard is not proof against a certain amount of warp and wind and that mice whose mechanics perform well on, say, a solid concrete floor may possibly misbehave on blockboard.

The design is 16 tracks square, each of not less than 16.5mm. nominal width. Wall sections are 50mm. high × 12mm. thick and fixed to 10mm. dowels at 175mm. intervals, removable to allow different maze configurations.

The walls are painted in white gloss with red tops, which gives a very pleasing effect; in the centre is a well to permit access to the centre to rescue an exhausted or demented mouse.

The target is a post at the centre of the maze, 200mm. tall and 25mm. square. The time is noted, by stop watch on a screen and timed down to the last trice if you prefer electronics to clockwork.

Not that any of it made much difference: only one of the mice demonstrated anything like the speed of a clockwork mouse — A Nonny. As it was incomplete, it was controlled from a switch console and a set of wandering leads controlled by clumsy human hands rather than the intended microprocessor.

This slave mouse was Meryl from an independent team of engineers from Marconi's Great Baddow, Essex research laboratories and was quite literally a lash-up. With its wide circular baseplate, just above the height of the wall, and its three boards bound together with insulating tape like a small tent, it rather resembled a Homburg with a bashed-in crown.

Its creators, David Wilson, George Davis and Robert Inder, had assembled it in their spare time, two evenings a week for the previous two-and-a-half months. Its drive unit seemed large and powerful and the whole unit was heavy, with a hefty power supply.

David Wilson explained that by contrast with some of the other entrants, who as a solution to the problem of power consumption had chosen the lightest possible weight, he had preferred the opposite route, overspecifying if anything.

From the short demonstration run under human control, it showed considerable stability but in the absence of its processor, which had developed a fault the previous evening, there was no meaningful brain activity from Meryl.

Light and elegant

At the opposite end of the design spectrum was a very polished-looking creation from Plessey's Mark Buckland and Irving Caplan, the former in charge of hardware, the latter software. Light and elegant, it looked the most promising contender as indeed it should be, since Plessey clearly regarded the Micromouse contest as a worthwhile area for sponsorship.

As a result Buckland and Caplan had more resources available than any other team, though they emphasised that there were few components in their machine called FRED (Free Roaming Electronic Device) which would not be available to home constructors.

They used a Cosmac 1802 processor by RCA, IR sensors and 6V DC Marx minipile motors driving through toothed belts and had been working on the machine since October. Unhappily, there was a bug in the software requiring last-minute re-programming of a ROM. They failed to correct it with the result that the machine performed only a spectacularly stable display of turning in circles followed by a stopping-to-think-about-it routine.

That prompted John Billingsley, ever-ready with a tart remark in his race commentary, to say: "Well I said give it a whirl, didn't I? Perhaps you should rename it Dervish". Despite the program bugs, there can be little doubt that FRED will be one of the contestants to look out for in the London heat. It looks stable and well-sorted from the mechanical engineering point of view.

A particularly admirable project has been attempted from three youngsters at

the Worthing sixth form college whose mouse was complete with a furry cover and although not yet featuring a processor, looked to have the capability of a good performance.

Algernon, built by Anthony Foord, Max Longley and Philip Woodland entirely from their own meagre resources, featured wide sponge-rubber slick tyres, a lateral thinking approach to traction which others might do well to consider.

They, like the Plessey team, had been reading both Mark Witkowski's and Nick Hampshire's articles in *Practical Computing* and were slightly irritated that some of the tricks in mouse design which they had worked out for themselves had been revealed by Witkowski.

Two remaining projects originated from within the Portsmouth department: Freewheelin' Franklin, named doubtless after the Robert Crumb cartoon cowboy, and Invader, interestingly featuring TTL hard-wired logic with four-bit counters.

Invader, designed by Andy Coldwell, who built the device as a final-year project, was perhaps the most entertaining performer of the mice seen at play, and nowhere more so than in the denuded maze like an angry hornet and bowled over a couple of cats before expiring due to battery failure.

Conventional design

Freewheelin' Franklin was of more conventional design, by Brian Compston and Oz Osborn, but its problems were more mechanical than electronic, and a gearbox failure, apparently the fifth since the project began, forced its eventual retirement.

In the circumstances the judges, Lionel Thompson of Euromicro, Allan Sensicle of the Institute of Electrical Engineers and two lay judges spontaneously co-opted, Denise Winn of the *Observer* and Tim Hurst of BBC South, decided that the prize money donated by IBM, Vosper Thorneycroft, Nautech and Polkinghorne Industry, should be shared equally among the contestants.

Doubtless many of the contestants who reckoned to turn up were daunted when they actually tried out their mice, since their design is an engineering problem which requires skill in several areas. As John Billingsley put it: "The designer of the micromouse requires enormous ingenuity, an ability to assemble parts, which seems to be a dying art, and the ability to meet a deadline, which seems to be a dead art".

How many of the 100 would-be constructors will turn up at Imperial College on September 17? Your mouse may even earn you a trip to Japan for the all-Japan Contest next year.

A contestant sets his mouse in action to tackle the maze.

Personal accounts system to keep your records straight

THIS simple program provides a printed record of all your financial transactions for every month and a printout at any time of a summary of past dealings. The summary shows the monthly totals of each account classification and the personal balance sheet. It also shows the moving annual total of each account.

The disc storage is based on the use of random access to one file for each month. Individual accounts are treated as single precision numbers, so after conversion by

by Bob Williams

the MKS$ factor, they require four bytes. There are 255 bytes in the record, so we can have up to 63 accounts.

However, it saves a good deal of time on printout to record the moving annual totals on the file so we end with 37 current-month entries and 26 moving annual totals for the income and expenditure accounts.

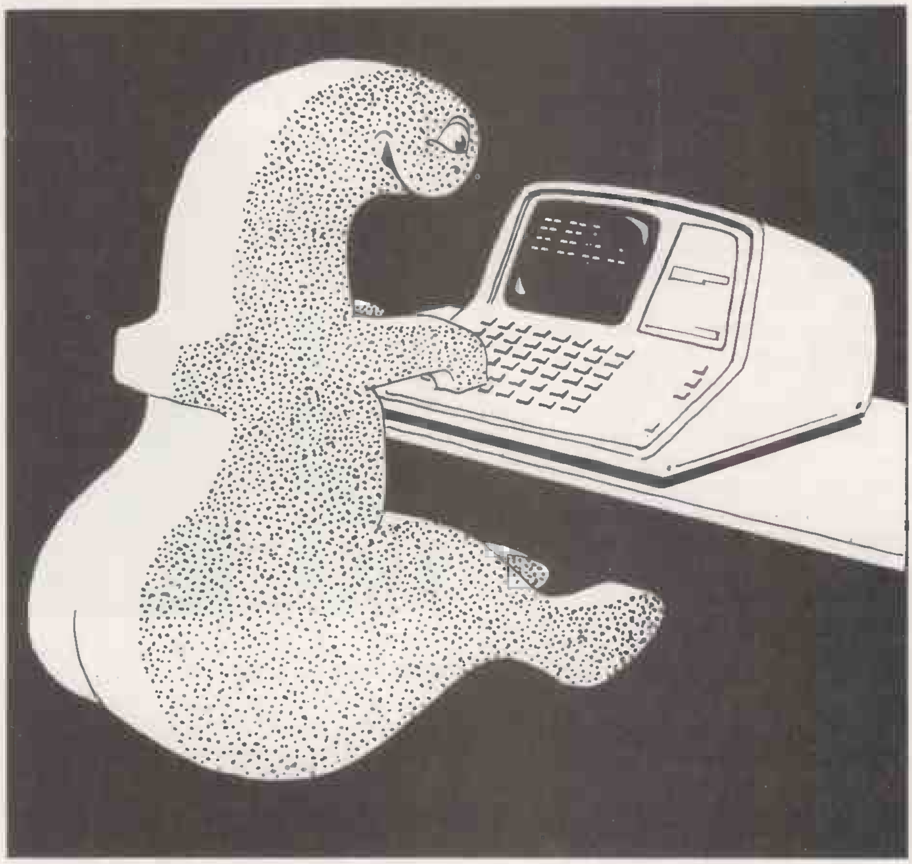
You can select and enter the account names which suit you in the data statement in lines 945-955, but make sure you are in the correct category or you must modify the program as it defines certain numbers as totals.

One reason that the program is so short is its assumption that the user can remember which are debits and which are credits. The entry routine asks you to enter:

- Pounds and pence
- Number of account to be debited
- Number of account to be credited
- Any notes you like for the monthly record

The following examples may help

DEBIT	CREDIT	
Current A/C	Cash	Cash drawn from bank
Current A/C	Tailor	Cheque for a suit
Current A/C	Life policy	Monthly life premium
Nett pay	Current A/C	Pay cheque
Cash	Tailor	Shirt for cash



A cross-check against your bank statement is built into the data entry system. When you indicate that you have finished all the entries, the bank balance according to the computer will be displayed in pounds and pence. If that does not agree with your statement adjusted for any unpresented cheques, it is likelier that you have made an error rather than your computer or the bank has, so you are given the chance to make more entries, or to amend. You can cancel any entry by repeating again with the debit and credit reversed.

Once you are satisfied with your entries, the computer opens a new random file, puts in the new data, picks up last month's moving annual total, adds the new data, and subtracts the data of 12 months ago.

Therefore is is not recommended to try to change date in previous months, unless you are prepared to fiddle with a sub-program to adjust all the subsequent moving annual totals.

Lines 2030 and 2040 contain a block to stop you entering data in any month except the next empty one.

```
100 REM ** PERSONAL ACCOUNTS PROGRAM ** BWACCTS1/BAS **
110 REM ** BY B.O.B.WILLIAMS ** OCT 1979
120 REM ** IN NEWDOS + FOR TRS 80 WITH ONE DISC DRIVE
130 REM ** TRANSACTIONS IN A MONTH ARE ENTERED IN THE FORMAT
140 REM **      AMOUNT--# OF A/C TO DEBIT--#OF A/C TO CREDIT
150 REM EXAMPLE:
160 REM  TO RECORD $50.00 SPENT ON TAILOR (A/C 17) PAID FROM
170 REM  CURRENT BANK A/C (A/C 29) ENTER:
180 REM  50,29,17,SUIT
190 REM  A PRINTED RECORD OF EACH ENTRY IS PREPARED AS YOU REPLY
200 REM ** BALANCE SHEET IS UPDATED WHEN ALL TRANSACTIONS ENTERED
210 REM ** OPTION OF
220 REM ** . PRINT OUT OF 5 MONTHS + MOVING ANNUAL TOTAL
```

```
230 REM **                   OR  6 MONTHS
240 REM
250 REM ** DATA IS FILED UNDER RANDOM FILE "NEWDATA"
260 REM **  RECORDS HOLD 63 AMOUNTS: 1-37 = CURRENT MONTH
270 REM **                             38-63=M.A.T'S EXPS/INC
280 REM **DICTIONARY ***************************************
290 REM ** A$(37)......NAME OF EACH ACCOUNT 1-27 INCOME/EXPENSE
300 REM **         .........................28-37 ASSET/LIABILY
310 REM ** M(63).......SUM IN EACH ACCOUNT FOR A MONTH
320 REM ** N...........MONTH NUMBER STARTING FROM
330 REM ** N1..........FIRST MONTH
340 REM ** Y1.........YEAR( 2 DIGITS)
350 REM ** Y.........YEAR
360 REM ** I..........COUNTER FOR ACCOUNTS
370 REM ** J..........COUNTER FOR MONTHS
380 REM ** JI..........NUMBER OF MONTH BEING ENTERED( N1=1 )
390 REM ** LI.........NUMBER OF ENTRY MONTH ( JAN=1 )
400 REM ** JL.........NUMBER OF LAST MONTH IN DATA FILE (N1=1 )
410 REM ** J1..........FIRST MONTH FOR PRINT OUT (N1=1 )
420 REM ** D$,DD$.....DUMMY STRING FOR FIELDING &
430 REM **            DETAILS ON DATA INPUT
440 REM ** V$.........VALUE IN BUFFER (= M(63) )
450 REM ** V(6).......6 MONTHS VALUES OF ONE A/C FOR PRINT OUT
460 REM ** VO.........VALUE (OLD) 12 MONTHS AGO (FOR UPDATING MAT)
470 REM ** VL.........VALUE LAST MONTHS MAT
480 REM ** Q..........MENU SELECTION
490 REM ** LM........LAST MONTH REQD (1-12)
500 REM ** BAL........LAST MONTHS CURR A/C BALANCE(FOR ENTRY CHECK)
510 REM ** DR..........NUMBER OF A/C TO BE DEBITED
520 REM ** CR..........NUMBER OF A/C TO BE CREDITED
530 REM ** P...........USED TO INPUT POUNDS ON ENTRY
540 REM ** SIGN CONVENTIONS  ********************************
550 REM ** EXPENSE/INCOME ACCTS
560 REM ** EXPENSES ARE POSITIVE ON FILE
570 REM ** INCOMES  ARE NEGATIVE ON FILE
580 REM ** ASSETS   ARE POSITIVE
590 REM ** LIABILITIES  NEGATIVE
600 REM ** FOR PRINT OUT THE SIGN IS REVERSED ON THE
610 REM      INCOME A/CS
620 REM ** DATA FILES ************************************
630 REM ** DATA IS STORED IN RANDOM FILE NEWDATA
900 REM ** PERSONAL ACCTS PROGRAM ** BWACCTS3/BAS *********
920 CLEAR 1000
930 DIM A$(37),M(63),V(6)
940 REM ** READ IN ACCOUNT NAMES  *************************
945 DATA : REM 18 EXPENSE HEADINGS THEN "TOTAL EXPS"
950 DATA : REM 6 INCOME HEADINGS THEN "TOTAL INCOME","NET CHANGE"
955 DATA : REM 9 ASSET/LIABILITY HEADINGS THEN "NET WORTH"
960 FOR I=1 TO 37:READ A$(I):NEXT I
980 REM ** DATE DATA **************************************
985 M$="JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC"
990 N1=4:Y1=78:REM ** START AT APRIL 1978 **
993 CLS
1000 REM ** MAIN MENU ***************************************
1010 PRINT"HIT 1 TO INPUT A MONTH'S DATA"
1030 PRINT"HIT 3 FOR PRINT OUT"
1040 PRINT"HIT 4 FOR ACCOUNT NUMBERS"
```

(continued on page 73)

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Kit Spencer
General Manager
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(continued from page 71)

```
1060 INPUT Q
1070 ON Q GOTO 2000,1000,4000,5000
1990 REM **INPUT ROUTINE  ***********************************
2000 OPEN "R",1, "NEWDATA"
2002 FOR I=0 TO 63:M(I)=0:NEXT I
2005 INPUT"ENTER MONTH TO INPUT MM,YY";LI,Y
2007 REM ** CALCULATE MONTH # AND CHECK IT IS NEXT ONE  *******
2010 JI=LI-N1+12*(Y-Y1)+1
2020 JL=LOF(1)
2030 IF JI=JL+1 GOTO 2060
2040 IF JI<JL+1 PRINT"DATA ALREADY ENTERED THINK AGAIN":GOTO 1010
2050 IF JI>JL+1 PRINT"NOT THE NEXT MONTH":GOTO 2005
2055 REM ** LPRINT HEADING FOR ENTRY RECORD  ******************
2060 LPRINT"DATA ENTRIES FOR  ";MID$(M$,(LI*3)-2,3);"  19";Y
2070 LPRINT"DEBIT","POUNDS","CREDIT","DETAILS"
2090 REM ** MAIN DATA ENTRY BLOCK  ***************************
2100 INPUT"TYPE POUNDS,DR#,CR#,DETAILS (0,0,0,0 TO END)";P,DR,CR,D$
2110 IF P=0 GOTO 2500
2120 M(DR)=M(DR)-P
2130 M(CR)=M(CR)+P
2140 LPRINT A$(DR),:LPRINT USING"#######.##";P,:LPRINT, A$(CR),D$
2200 GOTO 2100
2500 FIELD 1,112 AS D$,4 AS BAL$
2510 GET 1,JI-1
2520 BAL=CVS(BAL$)
2530 PRINT"CLOSING CURRENT A/C LAST MONTH WAS";BAL
2535 PRINT"THIS MONTH SHOULD BE";BAL+M(29)
2540 INPUT"KEY 1 TO AMEND,2 TO ENTER ON DISC";R
2550 ON R GOTO 2100,2560
2560 REM ** CALCULATE TOTALS & UPDATE BALANCES **********
2570 FOR I=1 TO 18:M(19)=M(19)+M(I):NEXT I
2575 FOR I=20 TO 25:M(26)=M(26)+M(I):NEXT I
2577 M(27)=M(19)+M(26)
2580 FOR I=28 TO 36
2582 FIELD 1,4*(I-1) AS D$,4 AS V$
2584 GET 1,JI-1:V=CVS(V$):M(I)=M(I)+V:NEXT I
2586 FOR I=28 TO 36:M(37)=M(37)+M(I):NEXT I
2590 REM ** GENERATE NEW M.A.T'S ******************
2600 FOR I=38 TO 63
2610 FIELD 1,4*(I-38) AS D$,4 AS V$,144 AS DD$,4 AS VM$
2620 GET 1,JI-12:VO=CVS(V$)
2625 GET 1,JI-1:VL=CVS(VM$)
2630 M(I)=VL-VO+M(I-37)
2640 NEXT I
2690 REM ** LOAD DATA ON TO DISC ****************
2700 FOR I=1 TO 63
2710 FIELD 1,4*(I-1) AS D$,4 AS V$
2720 LSET V$=MKS$(M(I))
2730 NEXT I
2740 PUT 1,JI
2750 CLOSE
2760 GOTO 1010
4000 REM **  PRINT OUT ROUTINE  ******************************
4010 REM ** SPECIFY FORMAT **
4020 PRINT"HIT 1 FOR 5 MONTHS +MAT"
4030 PRINT"HIT 2 FOR 6 MONTHS"
4060 INPUT R
4070 PRINT"ENTER LAST MONTH REQUIRED"
4080 INPUT"MM,YY";LM,Y
```

(continued on next page)

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```
4090 REM ** CALCULATE NUMBER OF FIRST RECORD *****
4100 J1=LM-N1+12*(Y-Y1)-2-R
4150 OPEN "R",2,"NEWDATA"
4159 REM ** PRINT OUT TOP LINE HEADING UNDER LINED *****
4160 LPRINT "19";Y;
4165 FOR J=J1 TO J1+3+R
4170 JM=3+J-12*INT(J/12):IF JM<1 THEN JM=JM+12
4172 IF JM>12 THEN JM=JM-12
4175 LPRINT TAB(9*(J-J1)+22)MID$(M$,3*(JM-1)+1,3);
4180 NEXT J
4190 IF R=1 LPRINT "      M.A.T."
4195 LPRINT STRING$(79,"=")
4199 REM ** PRINT OUT MAIN TABLE  **********************
4200 FOR I=1 TO 37
4210 FIELD 2, 4*(I-1) AS D$,4 AS V$
4220 FOR J=J1 TO J1+3+R
4230 GET 2,J
4240 V(J-J1+1)=CVS(V$)
4250 NEXT J
4260 IF R=2 GOTO 4285
4265 IF I>26 GOTO 4285
4269 REM ** PICK UP MAT'S FROM DISC FOR 1-26 *******
4270 FIELD 2,4*(I+36) AS D$,4 AS V$
4280 V(6)=CVS(V$)
4284 REM ** CHANGE SIGN OF INCOME A/CS ******
4285 IF I<20 GOTO 4291ELSE IF I>27 GOTO 4291
4287 FOR K=1 TO 6:V(K)=-1*V(K):NEXT K
4290 REM ** UNDERLINE AND SPACE RULES  **********
4291 IF I=19 OR I=26 OR I=37 LPRINT STRING$(79,"-")
4292 IF I=20 OR I=27 OR I=28 LPRINT STRING$(79,"=")
4300 LPRINT A$(I),:LPRINT USING"########-";V(1);V(2);V(3);V(4);V(5);V(6)
4305 LPRINT""
4307 V(6)=0
4310 NEXT I
4315 CLOSE
4318 LPRINT STRING$(79,"=")
4320 GOTO1010
5000 FOR I=1 TO 37
5010   LPRINT I;"  ";A$(I)
5020 NEXT I
5030 GOTO 1010
```

Identifying that profitable moment for buying currency

A scientific strategy for buying and selling foreign currency, programmed on a micro for the maximum gains by the customer, is presented by Dr S J Taylor of the University of Lancaster.

PEOPLE who travel from the U.K. to other countries have to purchase foreign currency or travellers' cheques, denominated in either sterling or the foreign currency. One of the most important decisions facing travellers is the timing of their purchases.

Before this year, most people had to purchase their currency within a month of leaving the U.K. Exchange regulations have, however, been scrapped by the Government so a traveller can purchase currency at any time.

That freedom conveys an implicit decision — the choice of the day on which the currency purchase is to be made. Usually, there will be a choice of several days.

For instance, a holidaymaker flying to New York on July 1 has about 100 banking days to purchase currency if the flight booking is made on March 1. A cautious person would simply buy dollars at the last possible opportunity; someone more ambitious might study the currency quotes in the daily newspapers and, based on an assessment of future trends, buy dollars sometime between the two time limits, March 1 and July 1.

The possible reward from an ambitious strategy is substantial. In 1975, for example, $2.43 could have been bought for £1 on March 1 but only $2.18 on July 1 — an early purchase would obtain an extra 25 cents for every £1 spent. There are, similarly, potential losses if one is ambitious.

Theory and practice

In 1979, $2.02 would be given for every £1 on March 1 but much more, namely $2.19, on July 1. The moral is well known: in retrospect, we can take decisions perfectly and identify profitable opportunities. In practice, the purchasing decision is not easy and the purchaser must trade-off the possibility of a loss against that hoped-for, larger gain.

The strategy, like all others, does not give perfect results but it does appear to increase, on average, the amount of currency obtained per pound. All examples refer to buying dollars but the ideas are also applicable to other currencies.

It is popularly believed that there are trends in all kinds of economic variables. For example, graphs of the *Financial Times* share index appear to show the index rising steadily on occasions and falling on others. Pictures of foreign currency prices appear to have similar properties: in 1975 and 1976 the pound sterling continually lost value compared to the dollar, but since 1977 there has been a steady upward trend.

Forecast difficulties

Graphs usually obscure, however, two important facts. The first is that there are very substantial fluctuations and frequent reversals about the long-term trend and the second is that at any moment, say, half-way across the time axis on the graph, it is hard to predict the future price behaviour.

That difficulty in forming accurate forecasts has been studied by academics all over the world who conclude that trends do not exist and that the best prediction of tomorrow's price is today's price. As far as purchasing foreign currency is concerned, the best strategy is then to buy it all as late as possible.

Most people are surprised by those conclusions but they are hard to refute. Recently, however, progress has been made towards their refutation and this article is based on new research.

The new approach states that there are trends in so-called daily returns. In Basic the number of dollars available for £1 on day T will be written Z(T). The instructions

D = Z(T)-Z(T-1)
X(T) = 100*D/Z(T-1)

define the percentage change, X(T), in the currency price from day T-1 to day T. These percentage changes are important numbers for our strategy. When successive X(T) are positive, we wait, expecting to obtain more dollars, while if the X(T) are successively negative, we buy dollars before the price falls further.

(continued on next page)

The program for buying and selling foreign currency.

```
←LIST
50  REM  COPYRIGHT S.J.TAYLOR, MAY 1980.
60  REM  PROGRAM TO PURCHASE AND SELL DOLLARS
65  REM  DEFINE P,V, AND D.
70  REM  RECOMMENDED VALUES FOLLOW.
100 P = .9821
120 V = 0.034
140 D = .5
160  REM  CALCULATE OTHER CONSTANTS.
180 Q1 = ((1 - 2 * V) * P * P + 1) / (P * (1 - V))
200 Q = .5 * (Q1 -  SQR (Q1 * Q1 - 4))
220 R =  SQR ((P - Q) * (1 - P * Q) / (P * V))
240  REM  READ YESTERDAY'S STATUS
260  READ Z0,S0,G0
265  PRINT
280  INPUT "TODAY'S QUOTE IS ";Z1
285  PRINT " DOLLARS"
300  REM  CALCULATE NEW S AND G,
305  REM  USING NEW X AND OLD S AND G.
320 X = 100 * (Z1 - Z0) / Z0
340 S1 = .9 * S0 + .13333 *  ABS (X)
360 G1 = Q * G0 + R * X / S1
370 S1 = .001 *  INT (1000 * S1 + 0.5)
380 G1 = .001 *  INT (1000 * G1 + 0.5)
390  PRINT
405  PRINT
420  PRINT "FORECASTING INDICATOR IS NOW ";G1
425  PRINT
440  PRINT "PRICE VOLATILITY IS NOW"
445  PRINT "   ";S1;" PERCENT"
460  PRINT
470  REM  WORK OUT TODAY'S RECOMMENDATION.
480  IF  ABS (G1) < D GOTO 620
500  PRINT
505  PRINT "THIS IS A GOOD OPPORTUNITY TO"
520  IF G1 > 0 GOTO 580
540  PRINT "BUY DOLLARS"
560  GOTO 640
580  PRINT "SELL DOLLARS"
600  GOTO 640
620  PRINT
622  PRINT
624  PRINT "NO ACTION IS RECOMMENDED"
640  PRINT
650  REM  PRINT TWO INSTRUCTIONS, TO STORE NEW STATUS.
680  PRINT
685  PRINT "NOW TYPE IN:"
690  PRINT
700  PRINT "1000 DATA ";Z1;",";S1;",";G1
720  PRINT
740  PRINT "FOLLOWED BY SAVE TRAVEL"
760  PRINT
900  END
1000  DATA  2.3,0.4,0.6
```

(continued from previous page)

We suppose that each X(T) consists of two components: X(T) = trend + a random number. We attempt to predict the trend but cannot hope to predict the random numbers. This predictive task requires a model, without which systematic and intelligent purchasing decisions are not possible. Our model is very simple.

On each day we suppose a coin is tossed. If the result is heads, today's trend is the same number as yesterday's trend, but if the result is tails, the trend changes to a new and totally random number. We do not assume the coin is fair; instead we find that the chance of a head — no change in the trend — is nearly a certainty for currency prices.

Market trends

This model captures many of the real-time behaviour of currency prices. We can think of the changes in the trend as reflecting important changes in world conditions, whether they be economic or political.

Sometimes, the currency markets are very active and the prices Z(T) go up and down by large amounts in a short time. At other times, relative calm prevails and Z(T) appears to be constant. For example, 1977 was a stable period but 1978 saw far greater day-to-day variations in the prices.

To measure the fluctuating level of price volatility, we "smooth" the absolute percentage price changes, ABS(X(T)), like this:

```
A = 0.1333*ABS(X(T))
S(T) = 0.9*S(T-1) + A.
```

The number S(T) then estimates the market activity at time T; in statistical terms, S(T) estimates the standard deviation of the random variable X(T). In 1975, S(T) declined from 0.3 to 0.2, reached a peak of 0.8 in 1977, fell to 0.1 and stayed there for most of 1977, then oscillated around 0.4 for most of 1978 and 1979.

Tomorrow's value

If today is day T and tomorrow is day T + 1, we want to forecast tomorrow's value of X from the values of X observed over today and preceding days. The forecast of X(T + 1) will be stored in F(T + 1). Our approach is to use two numbers P and Q, also S(T-1), S(T) and F(T) to calculate F(T + 1) as follows.

```
P = 0.9821
Q = 0.9609
F(T + 1) = Q*F(T) + (P-Q)*X(T)
F(T + 1) = S(T)*F(T + 1)/S(T-1).
```

The quantity G(T + 1) usually lies between -2 and + 2. Positive values mean we expect Z(T + 1) > Z(T) and vice-versa for negative values; statistically, G(T + 1) has a standard deviation equal to 1.

We conclude day T-1 with numbers stored as Z(T-1), S(T-1) and G(T-1) denoting price, price volatility and our forecasting indicator respectively. Then, on the next day, number T, the currency is quoted at a new price Z(T) and we revise the S and G arrays to obtain S(T) and G(T). The instructions can be made very concise:

```
INPUT Z(T)
D = Z(T)-Z(T-1)
X(T) = 100*D/Z(T-1)
A = 0.1333*ABS(X(T))
S(T) = 0.9*S(T-1) + A
B = 0.189*X(T)/S(T-1)
G(T + 1) = 0.9609*G(T) + B.
```

That process of iteration can, with ease, be programmed without using arrays, as will be the case in the complete program. All we need to record are Z, S and G. Then, when a new Z is obtained, we calculate new values of S and G and record the new Z, S and G. We can then repeat the iterative cycle as often as we please.

We use the numbers G(T) to decide when to buy foreign currency. The buyer will have a deadline by which the currency must be bought which will usually be a few days before departure abroad. Before the chosen deadline, there will be several opportunities to buy and each individual must decide how many opportunities to consider.

Decision period

We will consider a four-month decision period — on each day in that period, we either buy all the currency required or we wait until the next day and then buy or decide to wait again, and so on until, if necessary, the final opportunity when the currency must then be bought.

The recommended strategy is to calculate G each day using the currency quotation in the morning's newspapers. If G is positive, we expect to be able to obtain more dollars tomorrow than today and so the purchasing decision is deferred. On the other hand, if G is negative, we expect to be worse off if we wait.

Experience shows, however, that small negative values of G often occur when the price is falling. It is better, therefore, to buy the currency immediately only if G is less than a number D, and this D should be negative.

Suitable choice

Experimentation on the prices from 1974 to 1979 indicates that D×0.5 is a suitable choice; my thanks are due to my former student G Torkzadeh for calculating this value.

So far it has been assumed that our traveller is leaving the U.K. and hence buying currency. The strategy is easily modified for a traveller entering the U.K. or one who has returned here with unwanted foreign currency. The recommended time to sell is the first day on which G is greater than + 0.5.

The results of our recommended strategy are given for 15 non-overlapping decisions between January 1975 and December 1979 — three decisions a year for five years. On five occasions, dollars would have been bought as soon as possible, four times they would be obtained as late as possible and on the remaining six occasions the decision took place between the first and last possible days.

The success or failure of a purchase before the final deadline is assessed by calculating the dollars obtained using the strategy minus the dollars offered at the final deadline. Our 11 results range from a saving of 24 cents per pound to a loss of 12 cents per pound; there are seven savings and four losses. The 11 results add up to 51 cents or, as an average for the 15 decision periods, over three cents per pound.

Average saving

A seller of dollars would have bought U.K. currency before the deadline on 10 occasions, achieving an average saving of nearly three cents per pound per decision.

It is concluded that the strategy does improve both currency purchasing and selling decisions. Nevertheless, it has to be understood that savings are obtained on average with a range of results from very good to notable losses and, also, the average savings are comparable to the interest which could be obtained if the travel money was invested until the final deadline.

A microcomputer and regular access to newspapers are required to apply the strategy. The short program, which takes no more than five minutes, should be run every day. On an Apple II system, the program is loaded and started by the instructions

```
LOAD TRAVEL
RUN
```

The first few instructions initialise constants and read from the program (line 1000) data on the previous price (Z0), the previous volatility measure (S0) and the previous trend indicator (G0). After that, the latest price quotation is requested and must be entered.

Iterative cycle

The iterative cycle is then performed and, depending on the new trend indicator (G1), a specific recommendation is made. That recommendation is either buy dollars, if they are needed, sell dollars, if one has surplus currency, or do nothing. Afterwards, two instructions are requested and these might be:

```
1000 DATA 2.3, 0.4, 0.7
SAVE TRAVEL
```

The first of these completes the iterative cycle by deleting yesterday's numbers and inserting today's, while the second instruction files the revised program for use the next day.

The only technical difficulty is the initial choice of S and G when first using

(continued on page 78)

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(continued from page 76)
the program. That should be done a few days before there is a possibility of buying or selling currency. Initial values such as S = 0.4 and G = 0.0 are generally appropriate.

The research which forms the background to this article is described with more academic rigour in various papers, including *Economics Letters*, volume 3, pages 271 to 274, 1979. *Journal of the Operational Research Society*, volume 29, pages 971 to 980, 1978, and the *Australian Journal of Management*, volume 4, pages 135 to 149, 1979. The best single description will appear later this year in the *Journal of the Royal Statistical Society*, Series A.

Complex business decisions simulated on program model

S J Barrett outlines a model for practical decision-making in business and shows how to represent complex decisions with relatively straightforward programming.

THIS BUSINESS model program was designed for the Pet but should adapt easily to run on other machines in 8K of memory. The programming is not complex and I will deal with each decision input giving advice and what effect these inputs have.

A reasonable price is £4-5; it should be remembered that an increase in price causes a decrease in the market potential.

The standard micro-economic model suggests that the price should be determined at the point where the cost of producing one more unit equals the extra revenue obtained from that unit. However, even with the known relationships inherent in the model, ascertaining the price would be extremely difficult.

Market potential

Advertising expenditure affects the market potential and the strike duration indirectly via the calculated advertising category. Low expenditure will result in a low market potential and a reasonable figure is between £400,000 and £500,000.

Scheduled production is constrained by the amount of raw materials in stock and the capacity of the production machinery. Actual production will be the minimum of the raw materials stock, plant capacity and scheduled production. The market potential is the quantity of goods the firm can sell and is affected by various input factors.

A reasonable level at which to schedule production is between 1.5 and 3.5 million units. The model has a third constraint on production — strikes which in modern times are becoming a very real consideration. The strikes per month is a function of the wage paid and the strike duration is a function of the selling price, the wage, the bonus threshold, the number of employees and the advertising category.

The latter function is designed to have different levels of sensitivity to the various factors, e.g., workers are more concerned about their wage than the selling price of the firm's product. For reasons of accuracy in evaluating the production, the two strike factors are not turned into integers.

When ordering raw materials, an ordering cost of £100,000 is incurred. Materials need not be ordered every month but if the user decides to order, say, every other month, carrying costs of five percent of the raw materials value and 10 percent of the finished goods value must be considered. Also the finance charges associated with an overdraft should be considered.

List of variables in business game

The input variables
AE — advertising expenditure
BT — bonus threshold
E — number of employees
IM — investment in machinery
M — maintenance
P — price
R — quantity of raw materials to be purchased
SP — scheduled production
W — weekly wage given to employees

Other program variables
AC — advertising category
AD — administration cost
AP — actual production
BS — production before strikes
C — cash
CC — carrying cost of stocks
D — depreciation
ET — expenses total
F — finance charge
FG — finished goods stock reduction cost
FG — finished goods quantity
FV — finished goods value
IM — investment in machinery
LC — labour costs
MC — materials consumed cost
MP — market potential
NP — nett profit
OC — ordering cost
OP — number of units sold
PA — accumulated profit
PV — plant value
RM — raw materials quantity
SA — accumulated sales revenue
SC — share capital
SD — strike duration
SM — strikes per month
SR — sales revenur OP*P
UC — unit cost
V, X, XX, Y — miscellaneous temporary variables

Note that raw materials ordered in a month can be used only for production in the following month and they cost £1.50 per unit produced — that price remains constant. Finished goods carried from the preceding month are valued at last month's unit cost while any addition to them from this month's production are valued at this month's unit cost.

With this method of valuation, some error will enter into the finished goods stock value as the unit cost will be changing constantly. That is corrected when displaying the balance sheet figures.

When the finished goods stock-reduction expense is negative, that figure is not included in calculating the unit cost since, for example, if the market potential was zero and actual production was greater than zero, the unit cost would be zero — which is obviously wrong.

The business offers a bonus payment to each employee of £1 per 100,000 units produced over the bonus threshold. A high bonus threshold can increase strike durations and lower the market potential. The range is the same as for actual/scheduled production.

The number of employees relative to the wage paid will affect strike durations. The wage level also affects the market potential — indirectly via the strikes per month and administration costs.

Machine maintenance

The production machinery needs to be maintained and failure to do so will decrease the plant capacity since the depreciation expense has a wearing-out factor added to it which depends on the maintenance figure. Alternatively, that factor could be added to the investment expense though the overall effect would be the same.

Likewise, failure to invest in new machinery will decrease plant capacity since the book value of the machinery is depreciated by 2½ percent each month. Any firm will have either single or multiple objectives and in the model, performance is measured by the ratio of profit divided by the sales revenue — done on a cumulative basis as well as a monthly basis.

Thus the objective in this model is to maximise profits while simultaneously minimising the sales revenue. Whether or not this is desirable is another matter.

Tax has been omitted since the only effect it would have would be to lower the profit/sales revenue ratio.

The model is simple and here are a few useful additions that could be made.

- Save profit and loss and balance sheet figures on a cassette file so that the game can be played over long intervals.
- Reducing the firm's market potential in the next month whenever a stock-out occurs — i.e., market potential greater than the goods available.
- Quantity discounts on raw materials purchasing — one part of the economies-of-scale concept.
- Penalties via higher costs for rapid expansion of production.
- Seasonal and/or economic indices affecting the market potential.

Many of the assumptions underlying the model are my views entirely and are open to dispute — many changes could be made to customise it to individual requirements, e.g., are strike durations also a function of the profits being made?

There is no indication of how good the percentages are, but if you can get the accumulated profit/sales revenue ratio above 25-30 percent, you may consider yourself successful.

```
READY.
10 REM****** PET BUSINESS GAME/MODEL
20 REM****** AUTHOR S. J. BARRETT
30 FORI=1TO40:L$=L$+"▚ ■":NEXT:S$="▚ ■"
40 T=0:RM=3200000:C=5000000
50 UC=3.35:SC=20000000:FG=100000
60 PA=2135000:OT=1000
70 PRINT"▣";:R$="▶▶▶":R=0:SA=15350000
80 PV=12000000:R=0:SA=15350000:FV=335000
90 INPUT"DO YOU REQUIRE INSTRUCTIONS";A$
100 IFA$="Y"THENGOSUB2300:PRINT"▣"
105 GOTO140
110 PRINT"OPTION ?"
120 GETV$:IFV$=""THEN120
125 V=VAL(V$)
130 IFV>=1ANDV<=6THEN210
140 PRINT"▚OPTIONS AVAILABLE ARE :■"
150 PRINTTAB(10);"1 DECISION SCREEN"
160 PRINTTAB(10);"2 INFORMATION SCREEN"
170 PRINTTAB(10);"3 P & L REPORT"
180 PRINTTAB(10);"4 BALANCE SHEET"
190 PRINTTAB(10);"5 INSTRUCTIONS"
195 PRINTTAB(10);"6 END PROGRAM"
200 GOTO110
210 IFV=6THENEND
220 ONVGOSUB250,1300,1500,1750,2300
230 PRINT"▣";
240 GOTO110
250 REM*****DECISION SCREEN
260 PRINTL$;:PRINTS$;SPC(10);
270 PRINT"▚DECISION SCREEN■";SPC(13);S$;
275 RM=RM+R:C=C-R*1.5:T=T+1
280 PRINTL$;
290 FORI=1TO20:PRINTS$;SPC(38);S$;:NEXT
295 PRINTL$;"▩▩▩▩";
300 INPUT"▶▶▶▶▶▶DID YOU WANT THIS";A$
305 IFLEFT$(A$,1)="N"THENRETURN
310 INPUT"▶▶▶PRICE $";P
320 INPUT"▶▶▶ADVERTISING ('000) $";AE
330 INPUT"▶▶▶SCHEDULED PRODN. ('000)";SP
340 INPUT"▶▶▶RAW MATERIALS ('000)";R
360 INPUT"▶▶▶BONUS THRESHOLD ('000)";BT
370 INPUT"▶▶▶NUMBER OF EMPLOYEES";E
380 INPUT"▶▶▶THE WEEKLY WAGE $";W
390 INPUT"▶▶▶MAINTENANCE ('000) $";M
400 INPUT"▶▶▶INVESTMENT ('000) $";IM
410 PRINTR$;"▚PRESS Y IF INPUTS OK; N TO ";
420 PRINT"RE-INPUT■"
430 GETQ$:IFQ$=""THEN430
440 IFQ$="N"THENPRINT"▣";:GOTO250
450 M=M*OT:SP=SP*OT:R=R*OT
455 AE=AE*OT:IM=IM*OT:BT=BT*OT:CI=CI*OT
460 GOSUB500:GOSUB2100:GOSUB650:GOSUB900
470 RETURN
500 REM*****ACTUAL PRODUCTION
505 GOSUB1100
510 XX=INT(PV/3.529):IFXX>=SPTHENAP=SP
520 IFRM>=SPTHENV=SP
530 IFXX<SPTHENAP=XX
540 IFRM<SPTHENV=RM
550 IFV<APTHENAP=V
560 BS=AP
570 V=(SM*SD/31)*AP
580 IFV>APTHENV=AP
590 AP=INT(AP-V):RETURN
650 REM***** P & L CALCULATIONS
660 LC=E*W*4
670 IFAP-BT>0THENLC=LC+((AP-BT)/100000)*E
675 LC=INT(LC)
680 AD=INT(100*E*1/LOG(W))
690 CC=INT(.1*FG*UC+.05*RM*1.5)
700 IFC<0THENF=ABS(INT(.02*C))
710 IFC<-2000000THENF=ABS(INT(.10*C))
720 IFC>0THENF=0
730 RM=RM-AP:C=INT(C)
740 IFAP<=MPTHENGOSUB1050
745 IFR>0THENOC=100000:GOTO760
750 OC=0
760 D=INT(.025*PV+(1/LOG(M*5))*1000000)
770 PV=INT(PV+IM-D):OP=AP:FV=INT(FG*UC)
820 IFAP>MPTHENOP=MP:FC=INT((MP-AP)*UC)
830 MC=INT(AP*1.5)
840 ET=INT(D+MC+F+CC+AD+LC+FC+IM+AE+OC)
860 IFAP=0THEN870
865 UC=ET/AP:IFFC<0THENUC=(ET-FC)/AP
870 IFAP>MPTHENFV=INT(FV+(AP-MP)*UC):FG=FG+AP-MP
880 SR=INT(OP*P):NP=SR-ET:SA=SA+SR:PA=PA+NP
885 C=C+NP+MC+D+FC-IM
895 RETURN
900 REM*****INFORMATION SCREEN CALCULATIONS
905 IFAP=0THENPS=0:GOTO920
910 PS=NP/(P*AP)*100
920 PS=INT(PS*100)/100
930 AS=PA/SA*100:AS=INT(AS*100)/100
940 RETURN
1050 REM*****POTENTIAL > PRODUCTION
1060 V=FG
1070 IFMP-AP>FGTHENFG=0:GOTO1090
1080 FG=FG-MP+AP
1090 FC=INT((V-FG)*UC):RETURN
1100 REM*****STRIKE FACTORS
1110 SD=LOG(BT↑2/(60000↑2))*(8-1/P↑2)
1120 SD=SD/LOG(W/2.75)
1130 SD=SD*3000/(LOG(E)*LOG(W↑2))
1140 AC=INT(AE/245000+1)
1150 SD=(SD↑1/AC)/130
1160 SM=60000/(W*250+1000)-14.5/12
1170 IFSD<0ORSM<0THENSD=0
1175 IF E<2000 THEN SD=100
1180 RETURN
1300 REM*****OPERATIONS SCREEN
1310 PRINTL$;S$;SPC(10);
1320 PRINT"▚INFORMATION SCREEN■";SPC(10);S$;
1330 PRINTL$;
1340 FORI=1TO20:PRINTS$;SPC(38);S$;:NEXT
1350 PRINTL$;
1360 PRINT"▩▩▩▩▶▶▚MONTH";T
1365 PRINTR$;
1370 PRINT"▚RATIO OF PROFIT/SALES■";PS;"%"
1375 PRINTR$;
1380 PRINT"▚ACCUMULATED PROFIT/SALES■";AS;
1390 PRINT"%"
1400 PRINTR$;"RAW MATERIALS STOCK:";RM
1410 PRINTR$;"FINISHED GOODS:";FG
1420 PRINTR$;"ACTUAL PRODUCTION";AP
1430 PRINTR$;"PRODUCTION ▚BEFORE■ STRIKES";
1440 PRINTBS:PRINTR$;"MARKET POTENTIAL";MP
1450 PRINTR$;"UNIT COST THIS MONTH $";UC
1460 V=INT(PV/3.529*100)/100
1470 PRINTR$;"CURRENT PLANT CAPACITY:";V
1475 PRINTR$;
1480 PRINT"▚PRESS ANY KEY FOR NEXT OPTION■"
1490 GETA$:IFA$=""THEN1490
1495 RETURN
1500 REM*****PROFIT AND LOSS
1510 PRINTL$;S$;SPC(8);
1520 PRINT"▚PROFIT AND LOSS REPORT■";SPC(8);
1530 PRINTS$;L$;
1540 FORI=1TO20:PRINTS$;SPC(38);S$;:NEXT
1550 PRINTL$;"▩▩▩▩▶▶▶▶▶";
1560 PRINT"▚SALES REVENUE ■$";SR
1565 PRINTR$;"▚LABOUR COSTS","$";LC
1570 PRINTR$;"MATERIALS USED","$";MC
```

(continued on page 81)

(continued from page 79)

```
1580 PRINTR$;"ADVERTISING","$";AE
1590 PRINTR$;"MAINTENANCE","$";M
1600 PRINTR$;"FG STOCK RED'N","$";FC
1610 PRINTR$;"DEPRECIATION","$";D
1620 PRINTR$;"FINANCE COSTS","$";F
1630 PRINTR$;"CARRYING COSTS","$";CC
1640 PRINTR$;"ORDERING COST","$";OC
1650 PRINTR$;"INVESTMENT","$";IM
1660 PRINTR$;"ADMINISTRATION","$";AD
1670 PRINTR$;"PROFIT","$";NP,"MONTH";T
1680 PRINTR$;"ACCUMULATED PROFIT$";PA
1690 PRINTR$;"PRESS ANY KEY FOR NEXT ";
1695 PRINT"OPTION"
1700 GETA$:IFA$=""THEN1700
1710 RETURN
1750 REM*****BALANCE SHEET
1760 PRINTL$;S$;SPC(13) "BALANCE SHEET";
1770 PRINTSPC(12);S$;L$;
1780 FORI=1TO20:PRINTS$;SPC(38);S$;:NEXT
1790 PRINTL$;"";SPC(30);"MONTH";T
1800 PRINTR$;"LIABILITIES"
1810 PRINT"OWNER'S EQUITY"
1820 PRINT"SHARE CAPITAL","$";SC
1825 IF PA<0THENPA=0
1830 PRINT"REVENUE RESERVES","$";PA
1840 IFC<0THENX=ABS(C):GOTO1860
1850 X=0
1860 PRINT"CURRENT LIAB."
1870 PRINT"OVERDRAFT","$";X
1880 PRINT"TOTAL","$";SC+PA+X
1890 PRINTR$;"ASSETS":V=C:IFC<0THENV=0
1900 XX=INT(RM*1.5)
1905 IFSC+PA+X=PV+V+XX+FVTHEN1930
1910 Y=SC+PA+X-PV-V-XX-FV
1920 PV=PV+Y
1930 PRINT"CURRENT ASSETS"
1940 PRINT"CASH AT BANK","$";V
1950 PRINT"FG STOCK VALUE","$";FV
1960 PRINT"MATERIALS VALUE","$";XX
1970 PRINT"FIXED ASSETS"
1980 PRINT"PLANT VALUE","$";PV
2000 PRINT"TOTAL","$";PV+V+XX+FV
2010 PRINTR$;"PRESS ANY KEY FOR NEXT ";
2020 PRINT"OPTION"
2030 GETA$:IFA$=""THEN2030
2040 RETURN
2100 REM*****MARKET POTENTIAL
2110 V=EXP(SM/4)*EXP(P)*EXP(BT/3000000)
2120 V=V*(8.6-LOG(AE/1000)-EXP(AE/800000))
2130 MP=3400000-V↑1/AC*15000
2135 IFE<2000 THEN MP=0
2140 IFMP<0THENMP=0
2150 MP=INT(MP):RETURN
2300 REM*****INSTRUCTIONS
2310 PRINT"";SPC(11);"PET BUSINESS MODEL"
2320 PRINT""
2330 PRINT"YOU HAVE THE TASK OF RUNNING A"
2340 PRINT"FIRM WHICH IS SIMULATED BY THIS"
2350 PRINT"PROGRAM. THE OBJECT IS TO MAKE"
2360 PRINT"THE ACCUMULATED PROFIT/SALES"
2370 PRINT"REVENUE PERCENTAGE AS HIGH AS"
2380 PRINT"YOU POSSIBLY CAN. BELOW IS A SET"
2390 PRINT"OF FIGURES THAT COULD BE INPUT"
2400 PRINT"AND WOULD GIVE A MODERATE "
2410 PRINT"PERCENTAGE."
2420 PRINT"PRICE  4.25","ADVERTISING 500"
2430 PRINT"PRODUCTION 3200","MATERIALS 3200"
2440 PRINT"BONUS 2500","EMPLOYEES 5000"
2450 PRINT"WEEKLY WAGE 120","INVESTMENT 400"
2460 PRINT"MAINTENANCE 350"
2470 PRINT"PRESS ANY KEY TO CONTINUE"
2480 GETA$:IFA$=""THEN2480
2490 RETURN  READY.
```

Petplan offers training in wide area of company skills

A business simulation package, Petplan, written for the Commodore series 3000 microcomputer and marketed for £60 in the U.K. is assessed by Mike McDonald.

THE original authors are a company called Understanding Ltd and the package is available for other machine types apart from the Pet. Petsoft describes it as a general management business simulation game.

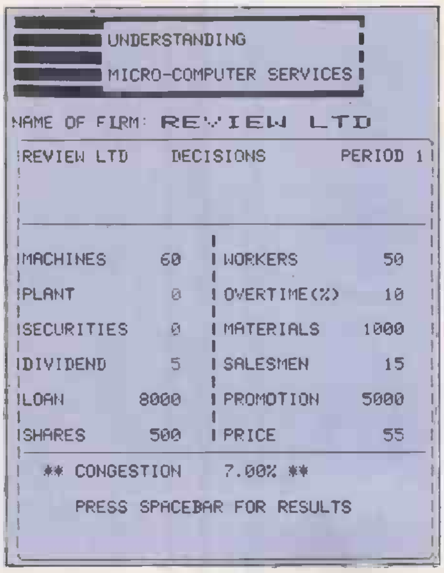
The product is only available on cassette but a disc-based version is due for release shortly. A 52-page manual is supplied with the cassette in a ring binder. A 32Kbyte Pet is required for running this package plus, of course, an external cassette drive. A printer may be employed optionally.

Petplan is a simulation of running a manufacturing company engaged in the process of making and selling Petals. The company is run on a monthly-period basis and the user has a number of criteria about which decisions must be made as each period begins. The package offers training in areas such as

Advertising and pricing.
manpower planning, capital investment.
Plant/machinery and material purchasing.
Cashflow forecasting, financing.
Double-entry bookkeeping, profit and loss and balance-sheet accounting.
Corporate planning and budgeting.

Each game may be single-handed or run on a team basis with a number of directors.

The user is given two aids within the program — he can probe both production



and demand and run a series of what-if questions against input data.

The balance of the options is either data entry for each move or display of the company's trading position. The master menu displays the following options —

1 Make decisions
2 Decisions and results
3 Probe production
4 Balance sheet
5 Accounts
6 Notes to accounts
7 Budget and forecast
8 Probe demand

Within the budget and forecast option, the user has a sub-menu offering displays of committed expenditure, cashflow, and period forecast. The company is driven by the user who must make decisions for each period regarding —

a. Purchase of machines
b. Ordering of plant
c. Declaration of dividends
d. Raising/redeeming of loans
e. Issuing of shares
f. Hiring and firing of workers
g. Overtime setting
h. Purchase of raw materials
i. Hiring/firing of salesmen
j. Spend on promotion
k. Selling price of the produce

Against those decisions, the user must account for depreciation of assets,

(continued on next page)

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fluctuations in wages/interest rates/taxation, a mobile workforce, i.e., leavers, market demand and pilfering.

The program has built-in a number of factors by which those variables are altered. They are machine price, plant price, salesman salary, and workers wages.

A series of constraints can impose themselves upon the player during the course of the game. Material shortage or salesman shortage can cause reductions in the number of items sold and delivered.

Cash constraints

Congestion can occur from overloading of a pre-set amount of floor space with material, people or machinery. Cash constraints are by far the greatest problems and the user must strive to avoid bankruptcy from over-committed expenditure, cash deficits, etc.

The users are provided with a variety of management reports at the end of each period which give a detailed picture of the standing of the company and information relating to each of the cost areas of the business.

Summarised results are produced automatically on completion of a period and the user may then examine further any of the following:

UNDERSTANDING
MICRO-COMPUTER SERVICES

NAME OF FIRM: REVIEW LTD

PERIOD FORECAST

PERIOD NUMBER	EFFECTIVE WORKERS	MACHINERY	OUT-PUT	SALES-MEN
1	90	50	638	48
2	72	49	576	43
3	58	47	509	38
4	46	43	444	34

Accounts — 1. Materials
2. Production
3. Finished goods
4. Cost of sales trading
5. Selling cost
6. Operating profit/cost of finance
7. Nett profit

Balance Sheet — assets and finance
Notes to accounts — machinery analysis
Rates and settings

Included with the documentation is a series of blank report formats for use by the player to record not only results but also to assist with forward planning. Those plans are of greater value to the novice as they typify how the data can be recorded and used in an informative format.

The objective of each player is obviously to eventually achieve a profitable and healthy business but there is no fixed point or target set of the user. The package could be improved if a suggested growth rate was set as a target.

Like any game, the program must work to a set of pre-defined rules and is, therefore, predictable once the correct formula is found. There are sufficient variables in the program to allow most users to obtain their money's worth before exhausting all of the possibilities and patience.

Good standard

The standard of the programming is good and the package appears to be reasonably bomb-proof with no way of accidental drop-out in the course of the game. For those users with a printer, the program has a screen-dump routine which can be used to reproduce displayed reports on to paper.

The manual is well laid-out but could have contained more information for those unlikely to be aware of the nature of a manufacturing business.

Directing a large investment portfolio from his armchair

by Martin Hayman

THERE ARE few enough people who claim that the micro makes them money directly, though there are doubtless many who say that it saves them considerable sums. Alf Rose, the self-styled electronic freak, boasts not only that the micro makes him money, but that it paid for itself in the first six months. This is the 16K Pet with CBM floppy disc drives and a printer.

After a career in the electronics business, Rose has turned with relish to the micro to manage his sizeable portfolio of investments. Since his retirement, his activities have shown a steady profit, with the voracious appetite for learning and relish for making money which have stamped his business career, with his self-written financial programs, his Oracle and Ceefax link and his own undoubted acumen.

In his smart, high-security apartment in the retired persons' quarter of Bournemouth, he peers from his leather armchair at the spidery characters of Oracle or Ceefax stock market reports, decoded by a Catronics kit on a standard TV, and periodically makes a call to instruct his London brokers to buy or sell shares for him.

Figure 1a. Example of an investment of £153,530.

```
DEV4 JAN 9TH. 1980.

GILT/H 58780 GILT/L 20000 BLD SOC 0
SHARES 42763 BONDS(CAP) 21133 UNITS 5730 BANK DEP 5124
RATES GILTS/H 12.6 %GILTS/L 3.5 %BLDG/SOC 13 %SHARES 5 %BONDS 12 %
UNIT/T 5 %TAX CERT 16 %
TOTAL INVESTMENT 153530

GROSS TOTAL INTEREST 11212.13

 GILTS GAIN  TAX. FREE AFTER YEAR 1000

OTHER CAPITAL GAINS
YOU ARE NOW IN THE 50% GAINS TAX BAND
CAPITAL GAINS TAX 1867.98
TOTAL CAPITAL GAINS BEFORE TAX 7535.96
CAPITAL GAIN SHARES @ ON OLD COURT BOND AFTER TAX 5667.98

TOP RATE 30%
YOU ARE LIABLE TO INCOME SURCHARGE
3713.4585 TAX ON INVESTMENT INCOME

AFTER TAX INCOME 14166.65

READY.
```

Figure 1b. Example of an investment of £31,000.

```
DEV4 JAN 9TH. 1980.

GILT/H 10000 GILT/L 10000 BLD SOC 5000
SHARES 5000 BONDS(CAP) 0 UNITS 0 BANK DEP 1000
RATES GILTS/H 12.6 %GILTS/L 3.5 %BLDG/SOC 13 %SHARES 5 %BONDS 12 %
UNIT/T 5 %TAX CERT 16 %
TOTAL INVESTMENT 31000

GROSS TOTAL INTEREST 2640

  GILTS GAIN  TAX. FREE AFTER YEAR 500

OTHER CAPITAL GAINS 2000
CAPITAL GAINS TAX 150
TOTAL CAPITAL GAINS BEFORE TAX 2000
CAPITAL GAIN SHARES @ ON OLD COURT BOND AFTER TAX 1850

TOP RATE 30%
 210 TAX ON INVESTMENT INCOME

AFTER TAX INCOME 4780

READY.
```

"I spend plenty of time on it", he tells me. "You can't afford to miss anything so it is really just like running a business — except you don't have any people". Behind him lies the steel-grey ruler of the sea: an almost completely event-free horizon. A far cry from the cut and thrust of electronics businesses in the days after the war, when Alf Rose ran a radio and components shop in Lewisham, London.

Rose's story is of a man who made an enthusiasm into a life-long business career. He likes to think of himself as someone who was always in at the beginning of the latest trend, and his firsts bear that out. As a youngster at school, he built a crystal radio set with two valves and since then he has never looked back.

He entered the electronics firm, Cossor, after leaving school at 14, where his first job was sticking on the labels with two pins. His aptitude soon paid off and he was promoted to tester. It is a skill which has stood him in good stead ever since.

Alf Rose at the keyboard of his 16K Pet.

Enthusiasm and drive

He recounts that since his Pet disc drive worked only intermittently when he took delivery of it last autumn, and the retailer's engineer was away on holiday, he decided to dismantle it and quickly ascertained that one of the circuit boards had been screwed down with a missing spacer washer and was shorting-out.

How many people would have the enthusiasm and drive to develop their own programs to manage a six-figure investment portfolio when they could entrust it to someone else and play golf all day, every day? Certainly Rose's initiation to computing was not encouraging.

Shortly before his retirement he persuaded the chairman of the company to which he had sold his interests to install a computer. He negotiated with ABS for the mini and oversaw its installation, confident that this next new thing in electronics would be his crowning achievement.

Justifying expense

"After that I toyed with the idea of buying a micro for a while. To be honest, I was looking for a way to justify the expense to myself, and then I hit on this one". Rose thinks that the price of the micro may still be high in relation to what it can do for most people. It's too expensive to be used just as a toy for games playing, he thinks. He thinks that programmers of commercial packages are people who know how to manipulate Basic quickly and effectively but who have little idea what the customer wants of his software. For instance, he started out with two financial programs which really didn't correspond with his needs.

For a start, Rose had to enter all the data on his shares and prices anew for each run, which was clearly unsatisfactory, so his first job was to create a data file, with a prompt for new data, prices or new shares.

He also took a course at the Dorset College of Further Education which is equipped for applied computer studies and boasts a comprehensive range of equipment.

At 63, Mr Rose was far and away the oldest, and, on his own admission, the most contentious of the pupils. He shows his diploma with justifiable pride and, but for a bank robbery that same day, would have had his picture taken by the local paper to add to a long file of cuttings on his own career.

Play cautious

There are some cautions — making money is not merely a matter of knowing how to write a good financial program. Never play with money you don't have, warns Rose. Don't gamble the £500 savings you have in the building society if you need it as a deposit on a house — nine times out of 10 the hot insider will not yield a fabulous return, and you may lose it all. As a general rule, play cautious.

"You don't lose by taking a profit", he tells me, and in his own case this means that he will usually sell a speculative share as it approaches a 30 percent gain. Needless to say, that sounds good enough to most people.

The success of profitable investment is correct timing which is only possible with up-to-date information. His teletext unit provides him with hourly updates of the FT Index and leading shares. The programs he has developed provide immediate information on the percentage gain or loss of each of his shares, what dividends they are paying, and many other details which allow him to make an instant decision.

Among the programs he has developed are an investment program which retains the entered prices as data. When run, it requests a yes or no answer for new or old prices. If the answer is yes, it lists the data lines, so that the new prices can be entered; otherwise the printout gives the total and unit cost price, current value, percentage loss or gain on each investment, with similar information on the complete portfolio. Interest and dividends are also given in detail by this program.

Another program deals with shares and gilts that have been sold in the financial year. It not only calculates the capital gains and investment income but also shows the total tax to be paid and which tax bands have been reached.

The input is arranged so that gilts held for more than 12 months, which are, therefore, free of capital gains tax, are displayed separately.

The tax band warnings are highlighted in reverse so it is possible to regulate investments to avoid going into higher-rate bands.

Investor's judgment

Of course, with all programs of this kind, the investor's judgment must be used to complement the computer. For example, when entering the percentage of interest on building societies, one has to anticipate the movement over a 12-month period and enter an average rate.

The equipment, including the teletext unit, cost him about £2,250 and during its first year of operation saved Rose £3,000. Next year his capital outlay should be negligible. His ideal in personal programs would be one which tells you which shares to buy — a kind of electronic crystal ball. This is Rose's next project, though such a program would only have a practical value with stable political and international conditions. The program would highlight which of a number of shares should, in theory, show the greatest growth. A certain amount of judgment, correct interpretation and good timing would still be required.

Micros should supplement textbooks — not replace them

What is the role of programmed teaching aids? Using two practical examples, Rex Tingey offers his answer to the question.

WHEN first acquiring my Pet, I was told by many of my colleagues that it was only good for playing games — an attitude I have been determined to disprove.

The major field of usefulness for the simple Pet 8K should be in education, where the large school may have a classroom-full of them, a small school have perhaps two on hand, and the lonely house in the Outback, may have a Pet for the children of the farmhouse and the near neighbours. Its completeness, simplicity of operation and excellent serviceability make it suitable for the task.

Within 8K, the work of programming teaching programs with logical question-and-answer responses, using subroutines for explanation and expansion, is quite simple but very limiting as the memory available will only allow the coverage of a small part of a section of a subject, in one program.

Even 32K is limiting in that respect, mainly because real word data must be used. Even with mathematical programs, Basic should be used so that they are understood upon listing, then alterations and amendments may be made by the teacher or other supervisor to change the slant of the subject or to update it.

Smaller machines

The answer is to use those smaller machines for consolidation, rather for the primary learning process — to supplement the textbook rather than to replace it. A good textbook has complete information presented in a logical form which can be digested quickly by the able, or more slowly by the less so, with outside help if required.

At the end of the lesson, or day, the student can sit down at the Pet and consolidate his newly-gained knowledge with a test.

Yet a computer-run programmed test bears no resemblance to the classroom examination. The computer test is fun; it is interactive, requiring and giving responses, indicating incorrect answers, allowing mistakes to be seen and rectified, and giving a running score. In addition, in the case of the failure to give a correct answer, that correct answer can be displayed, which is more like a classroom lesson than a test.

That implies a deeper involvement in the learning process, which is not apparent in the classroom examination, with its one-sided requirement of answers only.

Of the various standard classroom examinations available for conversion to Pet programs, only the multiple-choice type is completely suitable. However, other tests can be devised for the computer, which are not workable as classroom tests. They are tests which can unfold a question, piece by piece, revealing the next part on a correct response, or even a different response on an incorrect one, it can involve the random selection of not only a particular question, but the way in which a particular question is displayed and presented.

A good example of that involvement can be seen in my Petsoft program, Chemistry Tutorial, which contains as data all the elements, their symbols and atomic numbers. The major program displays one of the three possibilities, and first requires one of the other two as input, and then the other.

Correct answers cause a running score to be displayed as a reward for prowess, but incorrect input causes the correct answer to be displayed, jogging the memory and informing. This major part is aimed at the A-level student.

For the O-level student, an initial selection allows the easier program to appear, which involves only the element and its symbol, one or the other to be given with the other being required as input, but the atomic number is always displayed each time, giving an additional tutorial for future use.

An interesting programming feature is that, while the order of appearance of an element is random-selected, each element can appear only once during that run, avoiding repetition.

The program here is perhaps the simplest computer-orientated test. On running the program, the student is given, in this case, the type of geographic feature, concerned, such as capital city, followed by the first letter of the required name, which has been selected by the random-number generator, the rest remaining unknown.

If input is incorrect, the first two letters are displayed, and so on up to the first four. If the name has only a total of four, up to three letters are displayed before the "sorry" and the display of the full word. The mechanism for only displaying the first two of a three-letter word, such as SPA, has been left in, even though there are no such words in the data.

The program is aimed at the younger student armed with an indexed atlas, so that the more difficult places can be found for both map position and for spelling. As such, it can be seen to provide practice in the use of an atlas, private tuition, competitive study and consolidation of world geography, spelling and also use of a computer keyboard and practice on key-positioning.

The program occupies less than half of the 8K available, and could be expanded readily by increasing the data and by narrowing the fields of the blocks of data, then including more block titles in lines 2000-2120, so that you may have a block of, say, Italian town or cities.

Another simple expansion to adapt for the younger student is to increase the number of first letter clues from four to five or six, updating for the additional LEN(A$) accordingly.

The program is straightforward, first displaying the gosub title with copyright in a two-second time-hold, followed by simple instructions bringing in the main program with "Press any letter".

Random generator

The random generator is seeded with reciprocal jiffies, which are zeroed each pass by line 29 before the varying response time of the user input. Data is restored and a FOR-NEXT matches the selected number with a data position and takes the data occupying that position, as A$, forward out of the loop to find the appropriate block title and print it together with the first letter of A$. Input is B$ and is compared to A$, if it matches, a "Correct" line is displayed, followed by the running score.

Since the program is aimed at the younger student, the response to produce a next question is a definite one, that of pressing key "Q". That allows the correct spelling and the score to remain up on the screen for as long as the user may require, which a time-hold does not.

The find time for selections at the end of the bank is over half a second, whereas if data is held in string statements (X$,O to 10) and those banks of 11 are also selected, the time for recovery of one data block is reduced considerably, but the string statements and mechanisms take up far more program memory space.

However, if the prime concern is for speed of data recovery, rather than for space or loading time, it is worthwhile considering the alternative form of data storage. That is not true if the strings are re-DIMensioned, but is true and even more significant if data is sought and used for an intermediate checking procedure with input or whatever, even with no random selection involved.

String selection

A short section of the same program, but designed in the other way, is shown with the addresses of particular 0 to 10 banks to be accessed and selected by random number. Otherwise the program is similar, with the string selection becoming A$(A) in the end section.

To check that all the data has been entered, or no duplicate entries have been made, a simple device can be used: stop the run, enter from the keyboard Z + 231: GOTO250 and Return; that should bring the details of the last piece of data.

If it is not the last word of data, something is wrong, and so use the technique to check the end of the first block, and the beginning of the next, and so on, until the discrepancy is discovered. It may just be an extra comma, which is seen and counted as data.

It must also be noted that the words must be correctly spelt or the point of the exercise is lost. If any of the words in my listing are spelt incorrectly, it must be the printer which has made the error.

The program is possibly the simplest form of computer teaching aid, and will suit few subjects. Other suitable subjects which spring to mind being flora of the world and fauna of the world. An advance from the program here is the multiple-choice program, which is suitable for most school subjects up to O level.

By careful programming, 50 question-and-answer sets can be made to fit 8K. In my Petsoft multiple choice programs, that is achieved by double-, triple-, and quadruple-banking systems where total information for a question-and-answer set are found as A/and B$, and then may be broken down for further display and use.

Special appeal

What may especially appeal to the student is that serious study on the computer is like playing a game, the more serious intent being masked by the immediate scoring, by the unsupervising keyboard, which is personal yet provides an incentive over that of normal classroom competition, which is often only satisfactory for the brighter pupil. The computer in those terms is a helpful friend, rather than a teacher.

```
GEOGRAPHIA - Teaching Aid Program.
20 TI$="000000":GOSUB7000
30 PRINTTAB(6)"███COPYRIGHT (C) REX L TINGEY":PRINTTAB(11)"█NOVEMBER  1979
40 PRINTTAB(8)"███WAIT FOR INSTRUCTIONS"
80 IFTI$<"000002"GOTO80
100 G=0:H=0:GOSUB7000
110 PRINT"███THIS PROGRAM GIVES THE FIRST LETTER OF
120 PRINT"█A GEOGRAPHIC NAME,AND YOU TYPE IN YOUR
130 PRINT"█   GUESS. IF YOU ARE WRONG THEN TWO
134 PRINT"█ LETTERS ARE DISPLAYED, AND SO ON, UP
136 PRINTTAB(9)"█TO A LIMIT OF FOUR.
138 PRINT"█  SPACES OR HYPHENS ARE NOT ALLOWED.
140 PRINT"█
150 PRINT,,"PRESS ANY LETTER
180 GETZ$:IFZ$=""GOTO180
190 GOSUB7000:PRINT,,"█PRESS Q FOR NEW██
200 G=G+1:T=TI:S=1/T+.5
210 Z=INT(RND(S)*240):IFZ>231GOTO210
250 RESTORE
300 FORK=1TO231:READA$:IFZ=KGOTO2000
310 NEXT
500 DATAAMAZON,SEINE,THAMES,LOIRE,RHONE,VOLGA,DANUBE,SEVERN,LIFFEY,GANGES,TYNE
520 DATAZAMBEZI,TIGRIS,EUPHRATES,NIGER,DARLING,MURRAY,COLORADO,MURRUMBIDGEE
540 DATAMISSOURI,MISSISSIPPI,SASKATCHEWAN,TENNESSEE,HUDSON,URUGUAY,PARANA
560 DATAORINOCO,MACKENZIE,PEACE,CONGO,SNAKE,ODER,NILE,ENGLAND,SCOTLAND,IRELAND
580 DATAWALES,CANADA,AMERICA,ISRAEL,ETHIOPIA,LIBYA,CZECHOSLOVAKIA,YUGOSLAVIA
600 DATABULGARIA,ALGERIA.FRANCE,NEWFOUNDLAND,ITALY,MOROCCO,SPAIN,PORTUGAL
620 DATAFINLAND,NORWAY,SWEDEN,PARAGUAY,ALBANIA.ALGERIA,GERMANY,CYPRUS,KENYA
640 DATAAUSTRALIA,MAURITANIA,TANZANIA,RHODESIA,MEXICO,ANGOLA,INDIA,MONGOLIA
680 DATAPHILLIPPINES,JAPAN,BURMA,PAKISTAN,AFGHANISTAN,THAILAND,CAMBODIA
700 DATAVIETNAM,BORNEO,CUBA,SWITZERLAND,GREENLAND,AUSTRIA,MALTA,NICARAGUA
720 DATAGUATEMALA,PANAMA,VENEZUELA,CHINA,EDINBURGH,CARDIFF,BELFAST,DUBLIN
740 DATAPARIS,LONDON,MADRID,LISBON,ALGIERS,TANGIER,BUCHAREST,ROME,BELGRADE
760 DATAATHENS,COPENHAGEN,BERLIN,PRAGUE,BERNE,PALERMO,BRUSSELS,VIENNA,MOSCOW
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2000 IFZ<34THENPRINT"■RIVERS OF THE WORLD":GOTO2900
2020 IFZ>220THENPRINT"■MOUNTAIN":GOTO2900
2040 IFZ>198THENPRINT"■AMERICAN TOWN OR CITY":GOTO2900
2060 IFZ>176THENPRINT"■ENGLISH TOWN OR CITY":GOTO2900
2080 IFZ>143THENPRINT"■EUROPEAN TOWN OR CITY":GOTO2900
2100 IFZ>88THENPRINT"■CAPITAL CITY":GOTO2900
2120 IFZ>33THENPRINT"■COUNTRY"
2900 TI$="000000":PRINT"■
2980 PRINTLEFT$(A$,1)SPC(1)"IS THE FIRST LETTER OF"LEN(A$)"LETTERS.
3000 PRINT"▯":INPUTB$:IFB$=A$GOTO5000
3030 PRINTLEFT$(A$,2):INPUTB$:IFB$=A$GOTO5000
3050 IFLEN(A$)=3GOTO4060
3070 PRINTLEFT$(A$,3):INPUTB$:IFB$=A$GOTO5000
3094 IFLEN(A$)=4GOTO4060
4000 PRINTLEFT$(A$,4):INPUTB$:IFB$=A$GOTO5000
4060 PRINT"■"A$SPC(2)"-SORRY. CHECK YOUR SPELLING.":GOTO5060
5000 H=H+1:PRINT"■CORRECT: CONGRATULATIONS"
5020 PRINT"————————————————————————————————————————
5030 PRINT"SCORE: ATTEMPTS"G"CORRECT"H
5060 GETZ$:IFZ$=""GOTO5060
5070 IFZ$="Q"GOTO190
5080 IFZ$<>"Q"GOTO5060
7000 PRINT"■■  ■ I SPY GEOGRAPHIA "
7010 RETURN
```

Listing of part of the same program with data held as string statements.

```
200 G=G+1:T=TI:S=1/T+.5
210 Z=INT(RND(S)*21):IFZ>20GOTO210
220 IFZ=0GOTO480
230 IFZ=1GOTO580
240 IFZ=2GOTO680
250 IFZ=3GOTO780
260 IFZ=4GOTO880
270 IFZ=5GOTO980
280 IFZ=6GOTO1080
290 IFZ=7GOTO1180
300 IFZ=8GOTO1280
310 IFZ=9GOTO1380
320 IFZ=10GOTO1480
330 IFZ=11GOTO1580
340 IFZ=12GOTO1680
350 IFZ=13GOTO1780
360 IFZ=14GOTO1880
370 IFZ=15GOTO1980
380 IFZ=16GOTO2080
390 IFZ=17GOTO2180
400 IFZ=18GOTO2280
410 IFZ=19GOTO2380
420 IFZ=20GOTO2480
480 GOSUB6000
500 A$(0)="AMAZON":A$(1)="SEINE":A$(2)="THAMES":A$(3)="LOIRE"
510 A$(4)="RHONE":A$(5)="VOLGA":A$(6)="DANUBE":A$(7)="SEVERN"
520 A$(8)="LIFFEY":A$(9)="GANGES":A$(10)="CONGO"
530 PRINT"RIVERS OF THE WORLD"
550 GOTO2900
580 GOSUB6000
600 A$(0)="ZAMBEZI":A$(1)="TIGRIS":A$(2)="EUPHRATES":A$(3)="NIGER"
610 A$(4)="DARLING":A$(5)="MURRAY":A$(6)="COLORADO":A$(7)="MURRUMBIDGEE"
620 A$(8)="MISSOURI":A$(9)="MISSISSIPPI":A$(10)="SASKATCHEWAN"
640 PRINT"RIVERS OF THE WORLD"
650 GOTO2900
680 GOSUB6000
700 A$(0)="TENNESSEE":A$(1)="HUDSON":A$(2)="URUGUAY":A$(3)="PARANA"
710 A$(4)="ORTNOCO":A$(5)="MACKENZIE":A$(6)="PEACE":A$(7)="TYNE"
720 A$(8)="SNAKE":A$(9)="ODER":A$(10)="NILE"
```

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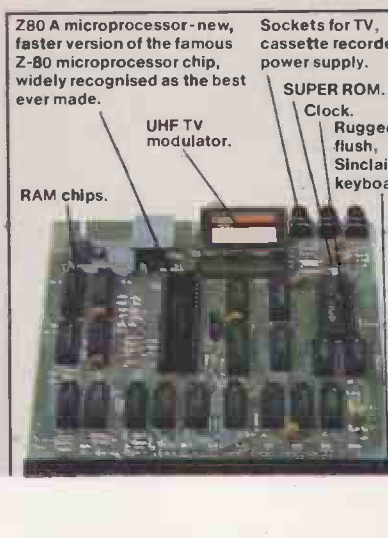

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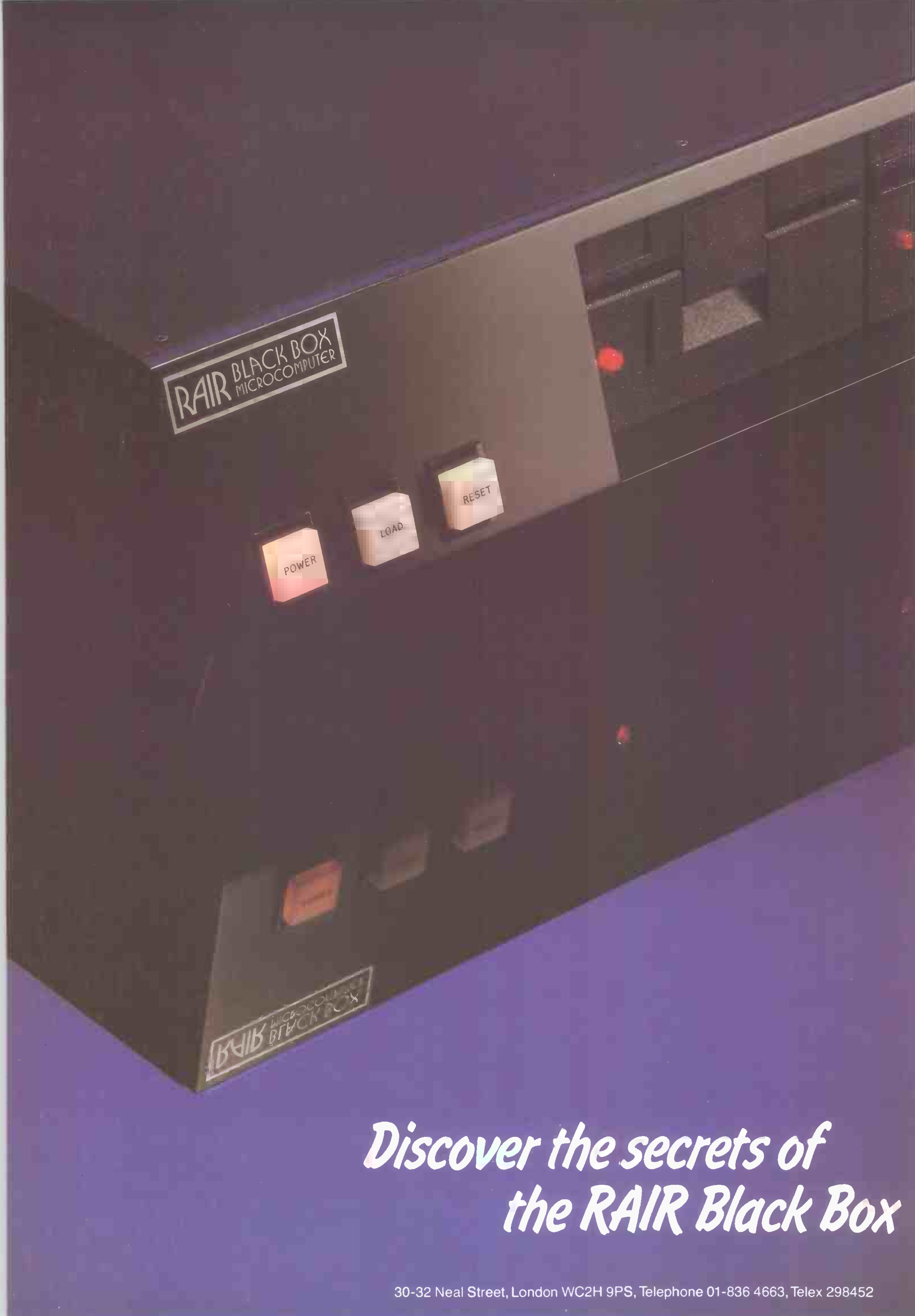

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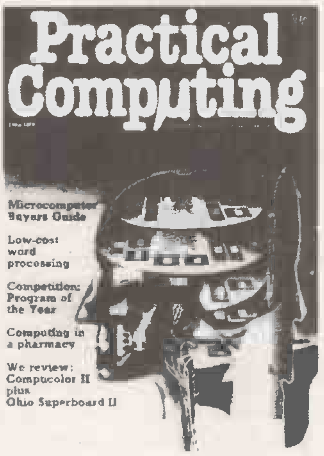

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Fitting maximum capacity into minimum area

Answers to major difficulties often seem obvious in retrospect; Mike Hughes shows how, with an injection of instinct, he cured some of Tuscan's technical headaches.

HAVING completed the initial design of the CPU section of the Tuscan on paper, I had a reasonably clear idea about the dimensions of the board. I was trying to work within the self-imposed constraints of a 10 in. square PCB.

The CPU looked as if it would occupy about 25 percent of that area on the assumption that I could obtain all its functions from the 20 or so chips described last month. I was pleased with the situation because I was already on target to make an improvement in packing density over conventional S-100 CPU cards.

If I had been designing a straightforward S-100 card, all I would have had to do was plunge into the mechanical layout of the board ensuring that all the respective lines were brought to the edge in the proper sequence to comply with S-100 pinning.

My problem, however, was to channel the respective signal lines into a busbar configuration to feed a bank of five S-100 sockets to house extension cards and, at the same time, use the same busbar within the main board to support the RAM, ROM, VDU and other I/O devices required.

Stand-alone system

They would be necessary to ensure that the Tuscan main board would operate as a stand-alone computer system and compare favourably to others on the market.

The sheer number of lines to the extension busbar was going to occupy a good deal of board area — at least 60 would radiate from the CPU — but there was no way of avoiding it. There could be savings, however, in the number of lines feeding the rest of the on-board system if I was careful.

I decided very quickly that I had to have a simple control busbar and a bi-directional data bus running through the on-board memory — figure 2. I hoped to manage with the straightforward four lines — memory read, memory write, I/O read and I/O write — for the former, while re-combining the separate data-in and data-out busbars from the S-100 bus would eliminate more wiring.

Inbuilt redundancy

In a conventional S-100 system, a great deal of redundancy is built into the overall structure. One would normally have a single card containing the CPU and discrete cards for RAM, ROM, I/O etc. — each of which would operate from the raw S-100 signals. Each card would have its individual buffers, address decoders and control bus decoders, as well as voltage regulators. In Tuscan, I would have to maintain a compatibility between what I had on the main board with what would have been hanging on to the S-100 busbar in a conventional system.

That was necessary to assure things like DMA integrity and to prevent ambiguities in the control of buffers which might have caused busbar clashes, i.e., two parts of the system trying to put data on to the busbars at the same time. Although, in theory, the problem was not difficult, the hardware involved would have to be minimised to prevent waste of valuable board space.

That was a real headache, made worse by the fact that the on-board system memory would be split into two totally different sets of addresses. RAM would start at address zero so that it would be compatible with CP/M while the 8K of ROM would be at the top end of the memory map, address EOOOH and upwards, to keep it out of the way.

Furthermore, I was going to be using plenty of I/O ports which would have their own set of addresses, and normal mode O interrupts would have to be catered for.

In simple terms, I had to design the on-board system so that it would pretend it was not connected to the S-100 busbar unless the CPU specifically addressed it — rather like a good child: seen but not heard unless spoken to.

At the earliest possible point in lay-out, I had to convert from S-100 signal paths to something more economic in terms of wiring and still maintain busbar integrity. I wanted to minimise buffering to keep the chip-count low.

I do not want to make too much of that problem because it is totally transparent to the end-user, but it should be of interest as it illustrates a hardware interfacing problem linked very closely to memory architecture which is very much of interest to the programmer.

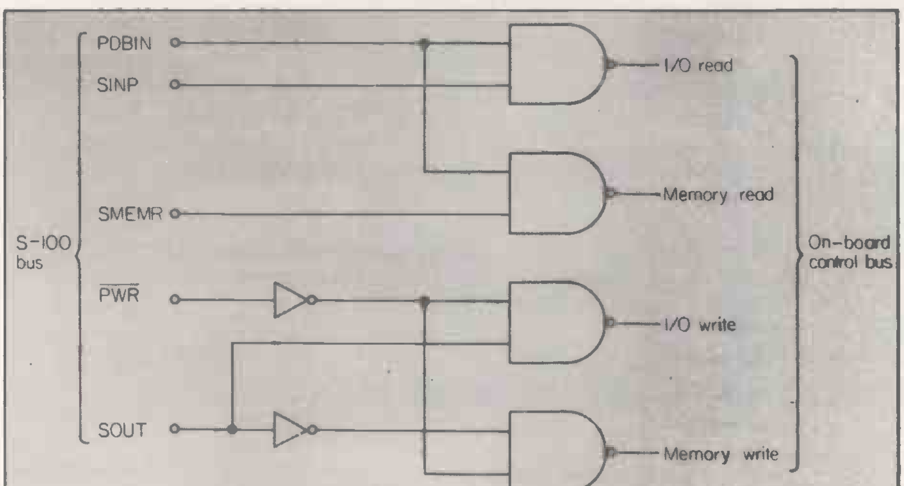
Complex problem

It is very easy to be glib and describe the end result as if it appeared like magic from the air but in practice, that particular problem took weeks to solve, and was probably the most difficult part of the Tuscan concept to realise. Like all solutions, the answer is obvious — when you know what it is. All I had to do was detect the following conditions:

1 Existence of a current address between 0000H and 1FFFH, for RAM.
2 Existence of a current address between E000H and FFFFH, for ROM.
3 Existence of a current address between 00H and 07H, for I/O.
4 Existence of an interrupt request from the S-100 VI lines.

Those lines could all be ORed together which would produce a composite signal whenever something on the main board was addressed. That signal could be qualified by the associated memory read, memory write, I/O read, I/O write or interrupt-acknowledge signals to control

Figure 1. Generating a simple four-line control busbar from S-100 signals.



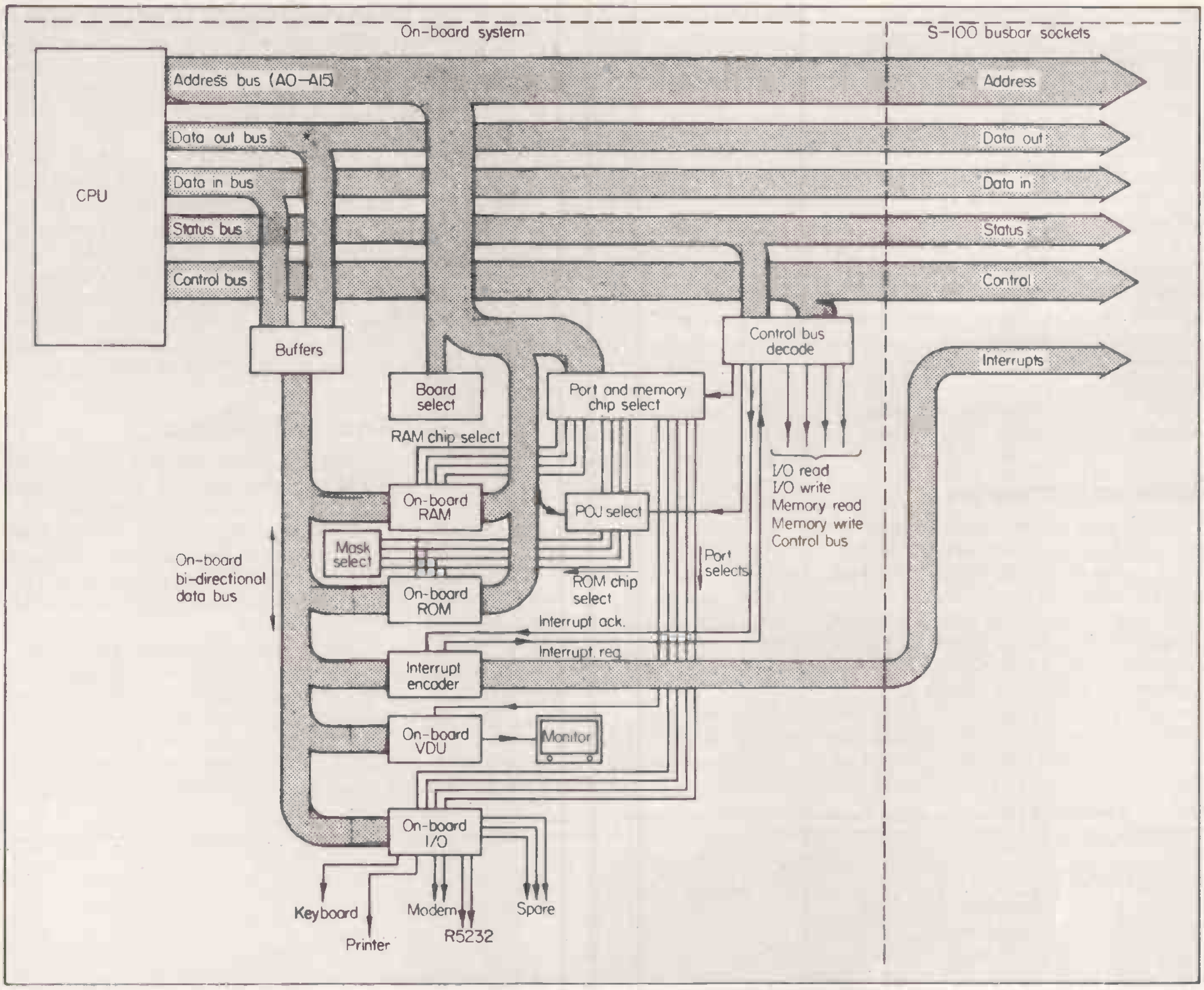


Figure 2. A simplified schematic of the proposed Tuscan System.

the activation and direction of the two data busbar buffers I would need to service the on-board system.

All that would have to be done with combinational logic and my mind turned, once again, to PROMs as a means to effect chip economy. Unfortunately, the number of original signals involved — the respective address lines and the associated control signals — would require a PROM with a very large address capacity.

That capacity would be out of all proportion in size and cost to what I required. I decided, therefore, to resort to conventional logic as it seemed feasible to accommodate all this into four or five discrete chips.

Search for economy

As often happens, when one starts looking for economies, one or two methods of streamlining come to light. For example, the signal which detects the bottom 8K of RAM is generated when the top three address bits are all "0" — done with a three input OR gate — whereas if one uses the high-order byte of the address bus for I/O addressing, the bottom eight I/O ports are detected when the top five address bits are "0" — figure 3.

The similarity here meant that I could use the signal which identifies the on-board RAM and combine it with address bits 11 and 12 to indicate that the on-board I/O was being addressed. By using similar economies — using logic to match the signals which were already available — I found I would be able to keep the board-select system compact.

Having decided on a bi-directional data busbar for the on-board system, I had to ensure that the combining buffers did not produce a bus clash on the internal busbar. To control that, I decided to use the S-100 status line $\overline{\text{SWO}}$ and its inverse to enable the output gates of the tri-state buffers.

When $\overline{\text{SWO}}$ was low, it would enable the buffer supplying data to the on-board memory and I/O system so that data could be written into whatever locations the address bus happened to specify. When $\overline{\text{SWO}}$ was high, and the Board Select system identified that the on-board system was being addressed, the buffer feeding data back on to the S-100 data in-bus would be enabled.

Making use of the $\overline{\text{SWO}}$ signal thus regimented the buffers with absolute certainty that they would be operating in the correct directions according to the wishes of the CPU or any other device requiring DMA.

Re-start code

To handle the eight vectored interrupt lines from the S-100 busbar, I would have to detect whenever one of these lines was pulled low and signify it to the CPU back down the busbar on the $\overline{\text{PINT}}$ line. As that was being done, I would have to generate the requisite eight-bit re-start code which the Z-80 expects to see when it services an interrupt.

The re-start code tells the CPU the address of the subroutine of the interrupt which has to be serviced. Although interrupts are very fast response methods of obtaining a reaction from a computer, the CPU does not respond instantaneously.

(continued on next page)

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When it receives the $\overline{PINT}$ signal, it carries on doing whatever was in-hand until it reaches a permitted part of its machine cycle and only then does it start to respond to the interrupt request. That delay might be as much as two or three microseconds depending on the operation the CPU was performing at the time of the request.

When it is ready, the CPU issues an interrupt acknowledge signal, SINTA, which is used to place the eight-bit re-start code on the data busbar at any precise moment. I would, therefore, use the signal to enable the tri-state outputs of a further buffer which was being fed by the re-start code obtained from the interrupt encoding chip.

Skeleton framework

Things were slowly becoming resolved and the skeleton framework of the on-board hardware was being developed on scraps of paper. Armed with the theoretical ability of being able to detect whenever the on-board system had to be accessed and the knowledge that I would be able to produce a simple four-line control busbar by decoding from the S-100 control signals, I had only to devise a method of producing individual chip-select signals for the discrete RAM and ROM chips and the I/O ports — figure 1.

There was, however, one big problem to be faced involving what is called a power-on jump.

A computer system will respond sensibly only when it is given a sensible set of operating instructions. In the absence of such instructions, it will either fail to do anything or run amuck. One could compare a computer without instructions to a newly-born child which has a brain but no internal knowledge to which the brain can react. In fact a computer is much worse off than the child because it does not even have latent instinct.

It is, however, possible to provide something similar to instinct by designing a CPU, in my case the Z-80, so that it always looks in one place to find what to do at the instant it is powered-up. That is a hardware feature and has nothing to do with software.

As soon as power is applied to a system, the CPU has to be re-set: that can be done with a manual push button or, as would be the case in Tuscan, with a simple resistor/capacitor circuit which produces a power-on clear pulse. The pulse sets all the relevant registers inside the microprocessor chip to pre-determined conditions and, in particular, sets the program-counter register to zero.

The program counter produces the signals carried by the address busbar. The Z-80 always expects to look at address zero immediately after power is applied and furthermore knows — again through the hardware re-setting of the registers — that it should receive an instruction from that address.

Depending on the nature of the first instruction, the device will respond and may then return, to find the next instruction after the program counter has incremented. The code of the first instruction gives sufficient information to the CPU for it to know what is expected of it next, e.g., it might indicate that the operation is a stack pointer address load which entails two bytes of following data.

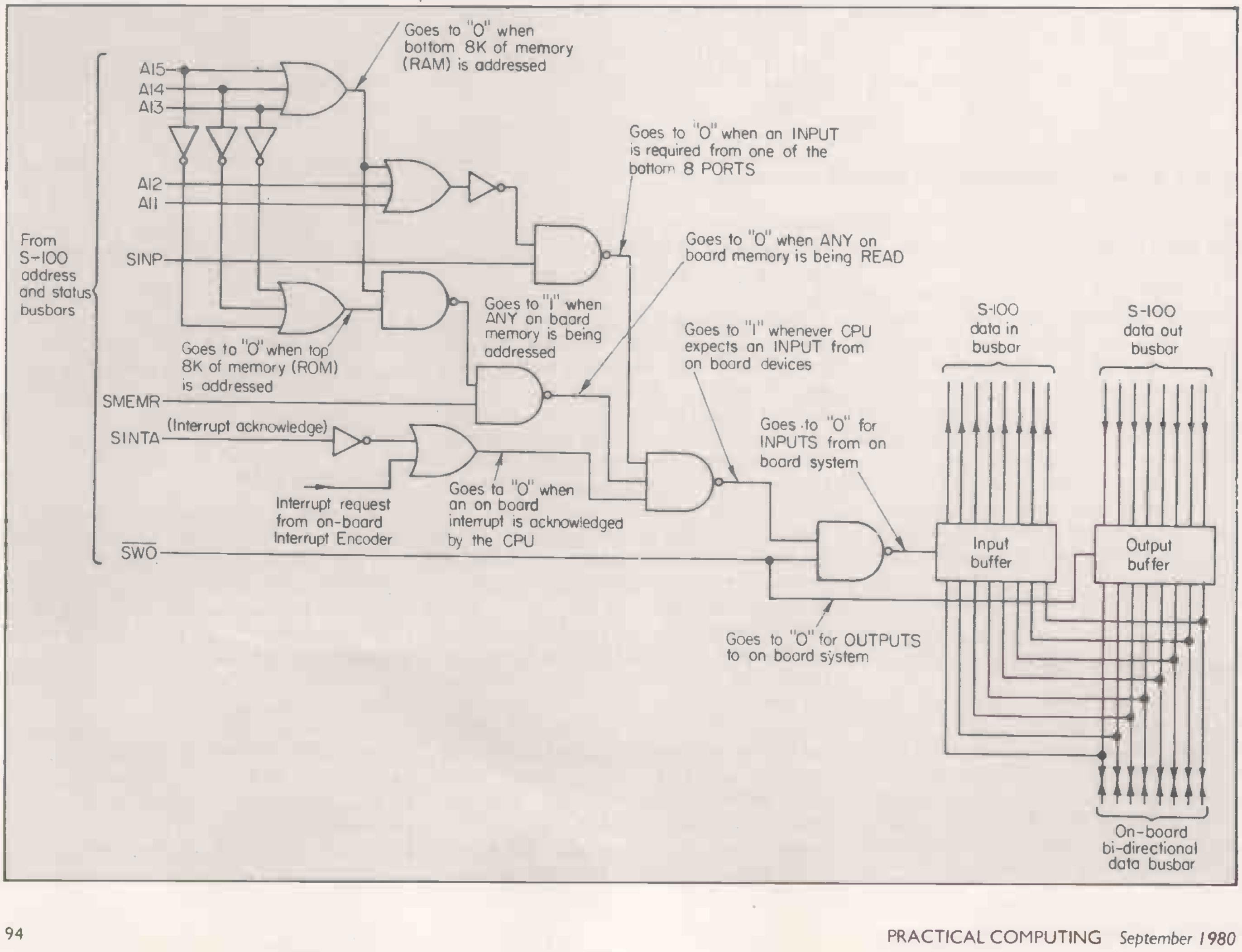
Address locations

The CPU would respond accordingly and obtain the next two bytes of data from the next two address locations, set-up its internal stack-pointer register and then increment the program counter register so that it is then looking at the fourth instruction byte to discover what to do next.

If the first few instructions are sensibly chosen, the system can be initialised and then it can progress to provide an unlimited degree of internal intellect.

All that is very fine but it presupposes that the instructions are in the correct address locations in the first place. Early

Figure 3. A simplified illustration of the Tuscan on-board select decoding system.



generation computers required the first few instructions to be entered by hand by means of toggle switches and a push button but the development of read only memories has made things much simpler.

A ROM contains permanent banks of pre-determined eight-bit codes at pre-determined positions within an addressable matrix. If such a ROM were to be used so that address zero corresponded to the position of one of these codes, we would be able to initialise a machine with no problems whatsoever — it is only necessary to pre-program a ROM with the proper codes.

The problem with Tuscan, however, was that we could not use a ROM at address zero because it had to be reserved for RAM to comply with the requirements of CP/M. The address I had set aside for ROM started at address EOOOH and extended up to the top of the memory map, FFFFH.

Ideally, I would have likely an instruction sitting at address zero to tell the CPU to jump to address EOOOH for its next instruction but that was just not going to be possible. That jump instruction is the power-on jump referred to earlier.

Clearly, that cannot be done with conventional software because it is physically impossible to provide the jump instruction. There are, however, various ways in which one can trick the CPU by using clever hardware techniques so that although it is working normally, one feeds it with phoney information.

Special buffer

One method is to use a special buffer which ensures that the data busbar always carried the data byte zero when the CPU addresses memory for its instruction. The code zero to a Z-80 is a NOOP code which tells the CPU to ignore that address and step on to the next.

Provided satisfactory hardware is present, the phoney NOOP code can be maintained on the data busbar for all addresses until the first location containing a real instruction is reached.

While that method is perfectly satisfactory, it requires an expensive tri-state buffer and some means of decoding the address busbar to determine when the address of the first genuine instruction has been reached.

The decoding has to be flexible so that the system can be forced to jump to any pre-determined address, dependent on the type of initialising firmware installed.

If at all possible, I wanted to simplify the power-on jump circuitry to economise on both space and cost and yet still maintain reasonable flexibility. The method I homed in on was somewhat devious but certainly effected the economies I was looking for.

When the address busbar sets-up address zero, Tuscan would normally have selected the lowest order RAM chip during memory read or memory write cycles. What I thought of doing was to temporarily divert the RAM chip select signal so that instead of enabling the output of RAM, it would be used to enable one of the four ROM chips — any one of the four could be chosen by means of a board jumper or selector switch.

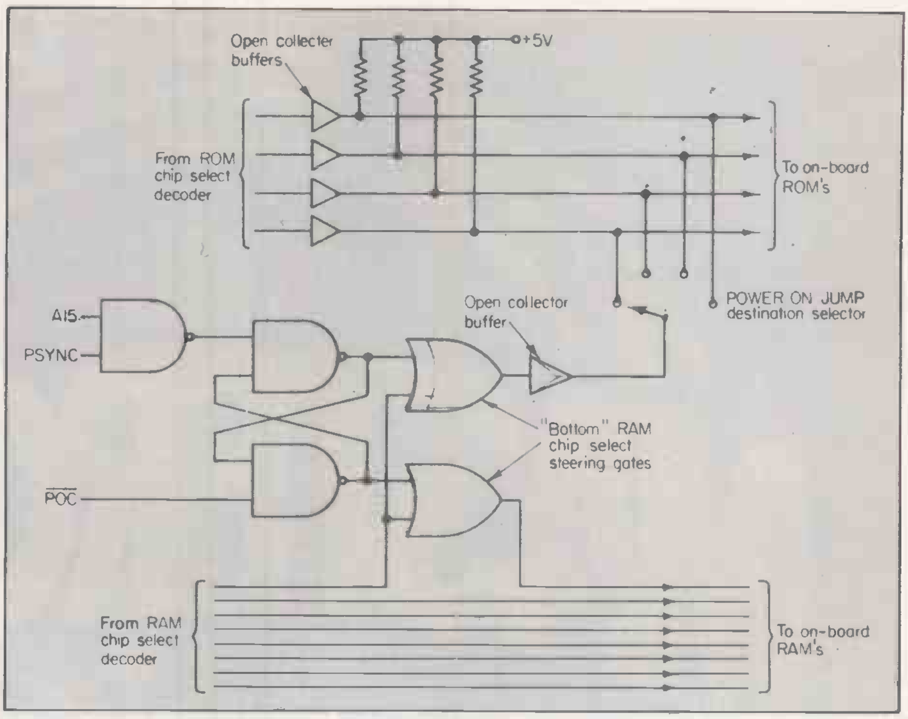


Figure 4. The Tuscan power-on jump system.

When the CPU thought it was receiving an instruction from address zero, it would, unknown to it, receive data back from the bottom address of the selected ROM. If the first instruction received was a JUMP operation code (C3H), the CPU would step on one address to find the first eight bits of the address to which it was supposed to jump.

Again, it would think it was obtaining this from address 0001H, but, in practice, would receive the information from the second byte of the ROM in question. That operation would be repeated one more time from a third address so that the CPU could form the complete address of the jump destination.

By making the jump destination the fourth address of the selected ROM, the CPU would, on its next instruction cycle, form the REAL address of the fourth location in the ROM chip and at that precise moment, I would have to make Tuscan revert to normal operation, i.e., remove the diverted RAM chip select and let the normal ROM chip select signal take over — figure 4.

At that point, the power-on jump would be completed and the system could be initialised by the fourth instruction onwards in the ROM.

When the idea was committed to paper, it turned out that the principle could be converted into practical hardware by making use of a few spare gates in existing chips plus two very simple TTL chips — one quand Nand and an open collector Hex buffer.

The technique would be to set a flip flop with the power-on clear pulse so that the RAM-chip select was WIRE ORed to the selected ROM chip and when address line A15 went high — at the instant of PSYNC — that would re-set the flip flop allowing the system to revert to normal operation. The open collector buffers would be needed to permit the WIRED OR function.

An unexpected bonus emerged from that. Because the ROM chip select lines were now to be driven by open collector outputs which were active "LOW", I would be able to use any, or all, of those chip selects to mask-out the on-board select signal which controlled the data buffers.

Deadline agreed

I had a reasonably precise idea of how much area would be required for the 8K of ROM and 8K of RAM and it seemed, therefore, as though I would have about one-third of the self-imposed board area for the I/O options and the on-board VDU. That seemed sufficient and I was able to confirm to Transam that our concept seemed likely to become a reality.

That was a big decision to make because nothing had been checked in real hardware but Transam had to commit itself to the project which included advance ordering of components, generation of firmware and setting a deadline for completion.

The date was June 1979 and we agreed to aim for a working first prototype by Christmas of that year and a possible launch in the early summer of 1980.


MASTERCARE
PET
PET

Modification of data files

Written on a modular-one mainframe computer in Basic, this program enables the user to examine and modify data files. The program is divided into three sections, the first of which lists all the text on the file; the second allows you to enter text on to the file and the final section is the editor which updates the file. File handling in Basic is reasonably standard apart from the command READ %X.

Tony Edgecombe

I String	Insert a string before the displayed line.
D	Delete the displayed line.
E String	Replace the displayed line with the string.
N	Move to the next line.
L	Move to the last line.
*	Re-set to the first line at text.
W	Wind-up and finish editing.

```
100 FILES TEXT1, TEXT2
110 DIM A$[60], B$[60], C$[60], D$[60]
120 PRINT TAB(30); "TEXT EDITOR"
130 PRINT TAB(30); "---- ------"
140 PRINT
150 PRINT
160 PRINT TAB(29); "(1) LIST TEXT"
170 PRINT
180 PRINT TAB(29); "(2) ENTER TEXT"
190 PRINT
200 PRINT TAB(29); "(3) EDIT TEXT"
210 PRINT
220 PRINT TAB(29); "(4) END"
230 PRINT
240 PRINT
250 PRINT "  PRESS APROPRIATE KEY THEN <RETURN>"
260 PRINT TAB(20);
270 INPUT I
280 IF I < 1 OR I > 4 OR I <> INT(I) THEN 120
290 GOTO I OF 300, 400, 520, 500
300 READ %1
310 LET I = 0
320 LET I = I + 1
330 IF END% 1 THEN 370
340 READ %1; I; A$
350 PRINT A$
360 GOTO 320
370 PRINT
380 PRINT
390 GOTO 120
400 PRINT
410 PRINT "ENTER TEXT ENDING IT WITH AN '*'."
420 PRINT
430 READ %1
440 LET I = 0
450 INPUT A$
460 IF A$ = "*" THEN 370
470 LET I = I + 1
480 PRINT %1; I; A$
490 GOTO 450
500 PRINT
510 STOP
520 REM ----===EDITOR===----
530 REM
540 PRINT
550 PRINT
560 LET L = 1
570 READ %1
580 FOR I = 1 TO L
590 IF END% 1 THEN 640
600 READ %1; I; A$
610 NEXT I
620 PRINT L, A$
630 GOTO 660
640 PRINT "ACCESS PAST END OF TEXT"
650 GOTO 560
660 INPUT A$
670 IF A$[1, 1] <> "I" THEN 930
680 REM                        ----===INSERT===----
690 REM
700 LET B$ = A$[2, LEN(A$)]
710 READ %1
720 READ %2
730 FOR I = 1 TO L - 1
740 READ %1; I; A$
750 PRINT %2; I; A$
760 NEXT I
770 LET J = I + 1
780 PRINT %2; J; B$
790 IF END% 1 THEN 850
800 LET I = I + 1
810 LET J = J + 1
820 READ %1; I; A$
830 PRINT %2; J; A$
840 GOTO 790
850 READ %2
860 READ %1
870 LET I = 0
880 LET I = I + 1
890 IF END% 2 THEN 570
900 READ %2; I; A$
910 PRINT %1; I; A$
920 GOTO 880
930 IF A$ <> "D" THEN 1100
940 REM                        ----===DELETE===----
950 REM
960 READ %1
970 READ %2
980 FOR I = 1 TO L - 1
990 READ %1; I; A$
1000 PRINT %2; I; A$
1010 NEXT I
1020 LET I = I + 1
1030 READ %1; I; A$
1040 LET I = I + 1
1050 IF END% 1 THEN 850
1060 READ %1; I; A$
1070 LET J = I - 1
1080 PRINT %2; J; A$
1090 GOTO 1040
1100 IF A$[1, 1] <> "E" THEN 1280
1110 REM                       ----===EDIT===----
1120 LET L = L - 1
1130 READ %1
1140 READ %2
1150 FOR I = 1 TO L - 1
1160 READ %1; I; B$
1170 PRINT %2; I; B$
1180 NEXT I
1190 LET I = I + 1
1200 READ %1; I; B$
1210 PRINT %2; I; A$[2, LEN(A$)]
1220 LET I = L
1230 LET I = I + 1
1240 IF END% 1 THEN 850
1250 READ %1; I; A$
1260 PRINT %2; I; A$
1270 GOTO 1230
1280 IF A$ <> "N" THEN 1330
1290 REM                       ----===NEXT===----
1300 REM
1310 LET L = L + 1
1320 GOTO 570
1330 IF A$ <> "L" THEN 1380
1340 REM                       ----===LAST===----
1350 REM
1360 LET L = L - 1
1370 GOTO 570
1380 IF A$ = "*" THEN 560
1390 REM                       ----===RESET===----
1400 IF A$ = "W" THEN 120
1410 REM                       ----===WIND UP===----
1420 END
***F
```

The shape of things to come

To take full advantage of the remarkable high-resolution graphics facility offered on the Apple II and ITT 2020, Malcolm Banthorpe presents a shape-table compiler which removes the hard work from encoding shapes into a form the computer can store and recognise.

THE APPLE II microcomputer and its ITT counterpart offer, by virtue of their hardware and software design, a high-resolution graphics facility which is exceptional among computers in their price range.

Apart from being able to plot individual points and draw straight lines between pairs of points, a very useful feature of Applesoft and Palsoft Basic is the shape table — this feature is also available from Integer Basic by means of a set of machine-code subroutines.

The shape-table facility enables the user to define up to 255 graphics shapes of any degree of complexity within the confines of the 280 or 360 × 192 resolution of the system and the size of memory available.

The resultant table can be stored on tape and subsequently loaded for use in any program by means of a SHLOAD command. Shapes can be displayed anywhere on the screen by means of a DRAW N AT X,Y command, where N is the number assigned to the shape and X and Y are the co-ordinates at which it is to be displayed.

Further useful commands are SCALE= and ROT= with which it is possible to expand and rotate the shape.

The implementation of such relatively-sophisticated commands on a small system has necessitated some compromises and limitations, but once these are understood, the commands available constitute a powerful tool for the creation

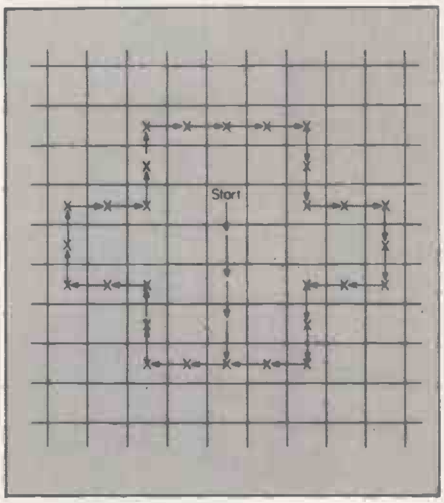


Figure 1.

of simulations, animated diagrams, design and computer art.

A simple, but valuable, use of a shape table is in the creation of an alphanumeric character set which can be used in conjunction with high-resolution graphics. Normally text and high-resolution graphics cannot be mixed on the screen, apart from four lines of text below the graphic window.

By defining one's own character set in a shape table, that limitation is removed and it becomes possible to label graph axes and diagrams fully. Moreover, the size of lettering may be varied to suit the application.

A problem, perhaps deterring many Apple users from using shape tables to any great extent, is the laborious process required to encode the shapes into a form that the computer can store and recognise. As the procedure is described in some detail in the Apple manuals, only a brief outline of the method will be given here.

The desired shape must first be drawn on a sheet of graph paper as a series of vectors, from a defined starting point — see figure 1. The vectors are then listed as a series of three-bit binary words, the most significant bit determining whether the vector defines merely a move or a plot and move, and the remaining two bits determining whether the move is up, down, left or right.

The three-bit words are combined into bytes, normally two three-bit words are thus combined and the two most significant bits of the byte are zero. Finally, the listed bytes are entered into a suitable section of memory with information defining the number of shapes in the table and a series of pointers to the start of each shape definition.

As will be appreciated, even from this brief outline, the procedure can be time-consuming and there is plenty of scope for making errors which can be difficult to trace when the final displayed shape does not turn out as planned.

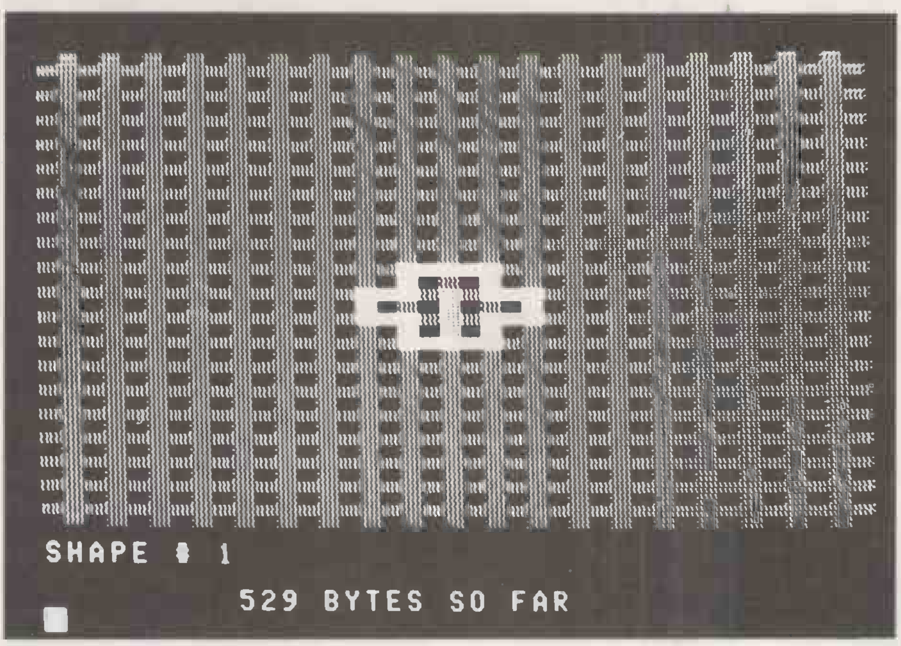
Thus it occured to me while compiling such a table by hand, that this was just the kind of repetitive task requiring mathematical precision to which computers are ideally suited.

The program makes use of the low-resolution mode to display a grid, corresponding to the graph paper, on to which, by means of the U, D, L and R keys — representing up, down, left and right — the desired shape is plotted and compiled simultaneously into a shape table starting at a previously-entered memory address.

The 40 × 40 resolution of the low-resolution graphics mode means that a similar restriction is placed on the dimensions of each shape but this will normally be found adequate, bearing in mind that the size of the displayed shape can be increased using the SCALE= command.

The shape-table compiler.

```
10   REM     SHAPE TABLE COMPILER
20   REM     BY MALCOLM BANTHORPE
30   REM     4/3/80
40   REM
99   REM     INITIALIZE
100  HIMEM: 8191: SCALE = 1: TEXT: HOME
105  VTAB(10): INPUT "SHAPE TABLE TO START
     AT ? ";ST
110  S = ST:I = ST + 514:D = ST: GOSUB 1000
119  REM     STORE START OF TABLE IN E8,E9
120  POKE232,L%: POKE233,H%: POKE ST,255:
     POKE ST + 1,0
129  REM     DRAWING ROUTINE
130  GR: COLOR = 4:N = N + 1:TI = I:F = 0
140  HOME: PRINT "SHAPE #"N
149  REM     PLOT 40x40 GRID
150  FOR K = 1 TO 37 STEP 2
160  VLIN 0,38 AT K: HLIN 0,38 AT K: NEXT
170  COLOR = 3
179  REM     START AT CENTRE OF GRID
180  X = 19:Y = 19: PLOT X,Y
189  REM     SAVE POINTER TO CURRENT SHAPE
190  D = I - ST: GOSUB 1000:S = S + 2:
     POKE S,L%: POKE S + 1,H%
199  REM     GET COMMAND FROM KEYBOARD
             AND INTERPRET
200  GET A$
205  HOME: PRINT "SHAPE #"N: PRINT: PRINT
     TAB(10)I - ST" BYTES USED SO FAR"
210  IF A$ = "D" AND Y < 39 THEN Y = Y + 1:
     C = 2: GOTO 280
220  IF A$ = "U" AND Y > 0 THEN Y = Y - 1:
     C = 0: GOTO 280
230  IF A$ = "L" AND X > 0 THEN X = X - 1:
     C = 3: GOTO 280
240  IF A$ = "R" AND X < 39 THEN X = X + 1:
     C = 1: GOTO 280
250  IF A$ = "P" THEN F = 1: COLOR = 15:
     PLOT X,Y: GOTO 200
260  IF A$ = "M" THEN F = 0: COLOR = 3:
     PLOT X,Y: GOTO 200
270  IF A$ = "E" THEN F = 0: GOTO 320
275  GOTO 200
279  REM     PLOT CURRENT POSITION
280  PLOT X,Y
290  IF J = 0 THEN A = C:G = F:J = J + 1
295  IF J = 1 THEN B = C:C = 0
297  IF J = 1 AND F = 0 THEN J = J + 1:
     GOTO 200
299  REM     COMPILE MOVES INTO BYTE
             AND STORE
300  POKE I,A + B * 8 + C * 64 + F * 32 +
     G * 4:I = I + 1
310  A = 0:B = 0:C = 0:J = 0:G = 0: GOTO 200
319  REM     COMPILE LAST 2 BYTES OF CURRENT
             SHAPE
320  POKE I,A + B * 8 + C * 64 + F * 32 + G *
     4: POKE I + 1,0:I = 1 + 2
329  REM     DISPLAY SHAPE IN HI RES MODE
330  HGR: HOME: INPUT "SCALE ? ";A$
339  REM     ERASE LAST SHAPE FROM SCREEN
340  HCOLOR = 0: DRAW N AT 180,80
350  IF A$ = "E" THEN 130
355  IF A$ = "X" THEN N = N - 1:S = S - 2:
     GOTO 130
360  IF A$ = "S" THEN 450
370  SC = VAL(A$): IF SC < 1 OR SC > 255
     THEN 330
380  INPUT "ROTATION ";R: IF R   64 THEN 380
400  ROT = R: SCALE = SC: HCOLOR = 3:
     DRAW N AT 180,80
410  GOTO 330
419  REM     STORE TABLE LENGTH IN 00,01
450  D = I - ST: GOSUB 1000
460  POKE 0,L%: POKE 1,H%
470  TEXT: HOME: VTAB(10): PRINT "TO SAVE
     SHAPE TABLE ON TAPE, ENTER"
480  PRINT "MONITOR VIA 'RESET' AND TYPE:-"
490  PRINT: PRINT TAB(10)" 0.1W ";
500  D = ST: GOSUB 2000: PRINT H$".";
510  D = I: GOSUB 2000: PRINT H$"W'
599  END
999  REM     CALCULATE DATA AS 2 BYTES
2000 H% = D/256:L% = D - 256 * H%:
     RETURN
1999 REM     DECIMAL TO HEX ROUTINE
2000 N = 0:H$ = ""
2010 A% = D / 16:B = A% * 16: D = D - B:
     N = N + 1
2020 IF D < 10 THEN C = D + 48: GOTO 2040
2030 C = D + 55
2040 H$(N) = CHR$(C):D = A%
2050 IF D > 0 THEN 2010
2060 FOR X = N TO 1 STEP -1
2070 H$ = H$ + H$(X): NEXT
2080 RETURN
```



Picture a. The table in figure 1 drawn on the low-resolution screen.

More complex shapes can often be profitably constructed from a combination of smaller shapes, resulting in some saving of memory space as there will often be repetition of some of the component shapes, which need only be defined once.

In all cases, the aim should be to define the shape in the minimum number of vectors compatible with acceptable detail and then expand as required. That results not only in memory economy but also ensures that the time taken to draw the shape is kept to a minimum — an important factor when programming an animation.

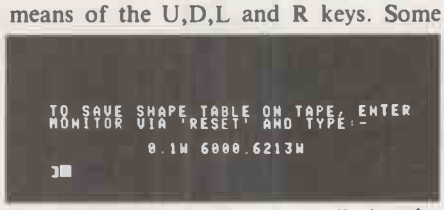
The grid is displayed in dark green with move-only vectors in red and plot and move vectors in white. These colours were chosen to be visible as distinct levels of grey on a monochrome display.

On running the program, the computer first asks for the starting address of the shape table, which is to be entered in decimal form. This must be clear of the high-resolution screen buffers and program space. On a 32K system, a suitable starting address would be 24576, being just above the HGR2 buffer allowing 8K of memory space for the table.

A 48K system could use the highest 8K or 16K of memory depending on the size and complexity of the table. A 16K system will need the start address somewhere below the HGR buffer at 8192 but above the area to be used for Basic program storage and so its exact location will depend on how much space you can spare. Care needs to be taken so that the table does not extend beyond 8191.

Once the start address has been entered, the grid described will be displayed and below it, the number of the shape. Also displayed in the text window is a running total of the number of bytes so far occupied by the table. Pressing "P" or "M" at this point will set the program to plot and move or move only respectively. That may be changed at any point while drawing the shape.

The desired shape can be drawn by means of the U,D,L and R keys. Some



Picture b. The type of message displayed on completion of the table.

users may prefer to use a group of adjacent keys such as I,J,K and M. This modification is achieved easily by changing lines 210-240. Beware of using more than one upward "move only" consequently as it may result in a zero byte being compiled, which would be interpreted during subsequent use of the table as the end of the current shape definition.

Although not strictly necessary, it is advisable to sketch the shapes you want before using the compiler. The 40 × 40 grid is not square, as it ideally should be and can give a misleading impression of the horizontal and vertical proportions of the shape. Sketching the shape on a sheet of graph paper first should help to avoid any confusion at this stage.

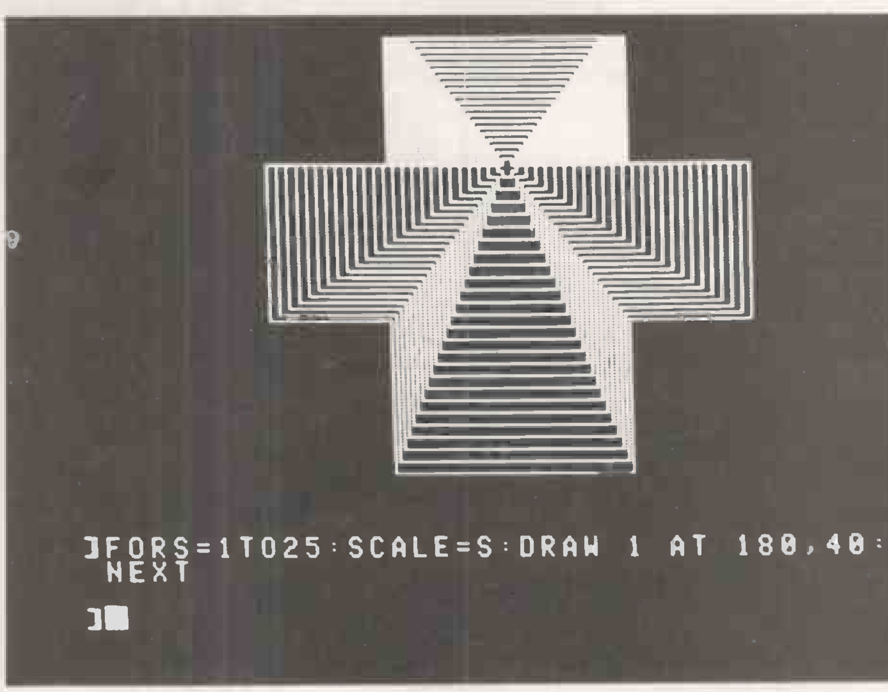
When the shape has been completed, pressing "E" will cause the program to exit the low-resolution mode and display a high-resolution screen. The computer asks for scale and rotation and then displays the current shape.

The effects of various scales and rotations may be examined. If you are not happy with the results, typing "X" in response to the next SCALE prompt will effectively delete the shape from the table and the screen will again display the grid, allowing the shape to be re-defined. If the shape meets your approval, typing "E" in response to the prompt will cause the grid to be displayed and allow the next shape to be defined.

On completion of the table, typing "S" in response to the prompt will return the screen to text mode and display an instruction for saving the table on tape. A subroutine is employed to convert the start and end addresses of the table to Hexadecimal notation so that having entered the monitor, the correct data for saving the table can be typed immediately.

Using this program as an aid, a library of shape tables can be built-up and used as required in programs.

Picture c. The compiled shape displayed 25 times with its scale incremented by one each time.



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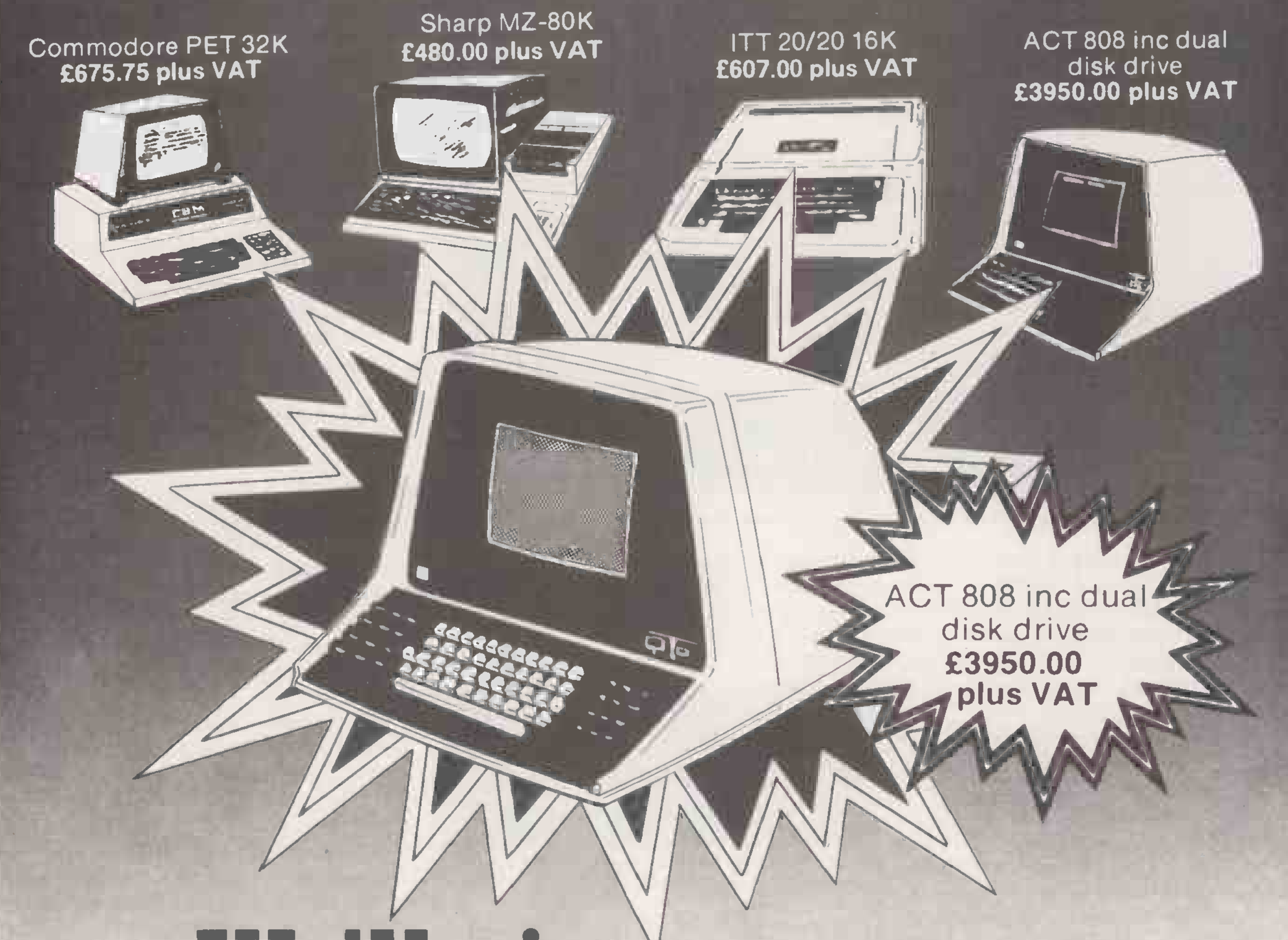

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This section is open to the Apple user. In every issue we hope to print ideas, hints and comments about the Apple and its suppliers. They must come from you, so write and tell us what you know.

Shape projection

THIS program is for the Apple II and is a shape projection system for use with shape tables writes QJ North of Brighton in Sussex.

To use the program, type RUN — you will be able to perform one of the commands:

L < shape file number >
— Loads a binary file containing shape table whose name format is SHAPE < file number
D < shape # >(▼ < X-co-ord > ▼ < y-co-ord >)
— Draws a shape in the shape table location X,Y. Leading 0s must be included. Also spaces (◁'s)
X < shape # >(▼ < X > ▼ < Y >)
— erases shape from screen. X and Y co-ordinates are usually optional, but it will tell you if it needs them.

By specifying either X or D without parameters, all commands from then on will effect that shape only.

R < angle > — rotate current shape.
< angle > — is in the range 1-4
Z < direction > — Zoom shape in direction I for in, or 0
Z < Repeat > for out. < repeat > can be used after specifying I or 0 to get it to zoom the shape several times.
E < status > — Set auto-erase I — on default
0 — off.
decides whether shape will be erased when zooming or rotating.
C — clear screen.
N — New shape table, clears old shape table, ready for loading new one.
Q — Quit. End program.

All error print statements in the program — lines 110, 190, 320, 370, and 450 — have CTRL-Gs at the end of them. Line 470 has a CTRL-D in it.

If you have a tape system, that could be replaced by a SHLOAD. Line 21 pokes the location of the shape table, if you site yours differently, change these statements. To a certain extent, you can program SPSS by creating a EXEC file with all your commands in it, with RUN SPSS at the front.

```
]LIST

10  HOME
11  REM ********************
12  REM *                  *
13  REM *       SPSS       *
14  REM * SHAPE PROCESSING *
15  REM *      SYSTEM      *
16  REM *                  *
17  REM * COPYRIGHT 1980,  *
18  REM * Q. J. NORTH.     *
19  REM *                  *
20  REM ********************
21  POKE 232,0: POKE 233,3: REM L
     OCATIONS OF SHAPE TABLE!
30 SC = 1:DIR = 0:ER = 1
40  ROT= 0: SCALE= 1
50  HGR : HCOLOR= 7
60 COM$ = "RDEZXCQLN"
70  DIM SH%(20,3)
80  VTAB 24: INPUT ">";A$
90  CALL  - 868
100  FOR X = 1 TO 9: IF  LEFT$ (A
     $,1) =  MID$ (COM$,X,1) THEN
      120
110  NEXT X: VTAB 24: PRINT "** I
     NVALID COMMAND": FOR X = 1 TO
      100: NEXT : GOTO 80
120  ON X GOTO 140,180,220,230,36
     0,410,440,450,490
130  GOTO 80
140  IF ER THEN  HCOLOR= 0: DRAW
     LS AT SH%(LS,0),SH%(LS,1)
150  IF SH%(LS,0) = 0 AND SH%(LS,
     1) = 0 THEN 80
160 RT =  VAL ( RIGHT$ (A$,1)) *
      16
```

```
170  ROT= RT: HCOLOR= 7: DRAW LS AT
     SH%(LS,0),SH%(LS,1):SH%(LS,2
     ) = RT: GOTO 80
180 LS =  VAL ( MID$ (A$,2,2)): IF
     SH%(LS,0) > 0 THEN  ROT= SH%
     (LS,2):SC = SH%(LS,3): SCALE=
     SC: GOTO 80
190  IF  VAL ( MID$ (A$,5,3)) = 0
      OR  VAL ( MID$ (A$,9,3)) =
     0 THEN  PRINT "** ILLEGAL PA
     RAMETERS": GOTO 80
200 SH%(LS,3) = SC
210 LS =  VAL ( MID$ (A$,2,2)):X =
      VAL ( MID$ (A$,5,3)):Y =  VAL
     ( MID$ (A$,9,3)): HCOLOR= 7:
      DRAW LS AT X,Y:SH%(LS,0) =
     X:SH%(LS,1) = Y: GOTO 80
220 ER =  VAL ( RIGHT$ (A$,1)): GOTO
     80
230  SCALE= SH%(LS,3)
240 RT =  VAL ( MID$ (A$,2, LEN (
     A$) - 1)): IF RT THEN RPT =
     1
250  IF ER THEN  HCOLOR= 0: DRAW
     LS AT SH%(LS,0),SH%(LS,1)
260  IF  RIGHT$ (A$,1) = "I" THEN
     DIR = 1: GOTO 300
270  IF  RIGHT$ (A$,1) = "O" THEN
     DIR = 0
280  IF DIR THEN 300
290  GOTO 310
300  IF SC < 255 THEN  SCALE= SC +
     1:SC = SC + 1: GOTO 330
310  IF SC > 1 THEN  SCALE= SC -
     1:SC = SC - 1: GOTO 330
320  PRINT "** SCALE ERR": GOTO 8
     0
330 SH%(LS,3) = SC
340  HCOLOR= 7: DRAW LS AT SH%(LS
     ,0),SH%(LS,1): IF RPT THEN R
     T = RT - 1: IF RT > 0 THEN  SCALE=
SH%(LS,3): GOTO 250
350 RPT = 0: GOTO 80
360 LS =  VAL ( MID$ (A$,2,2)): IF
     SH%(LS,0) > 0 THEN 390
370  IF  VAL ( MID$ (A$,5,3)) = 0
      OR  VAL ( MID$ (A$,9,3)) =
     0 THEN  PRINT "** ILLEGAL PA
     RAMETERS"
380 LS =  VAL ( MID$ (A$,2,2)):X =
      VAL ( MID$ (A$,5,3)):Y =  VAL
     ( MID$ (A$,9,3)): HCOLOR= 0:
      DRAW LS AT X,Y:SH%(LS,0) =
     0:SH%(LS,1) = 0: GOTO 80
390  SCALE= SH%(LS,3): ROT= SH%(L
     S,2)
400  HCOLOR= 0: DRAW LS AT SH%(LS
     ,0),SH%(LS,1):SH%(LS,0) = 0:
     SH%(LS,1) = 0: SCALE= SC: ROT=
     RT: GOTO 80
410  HGR
420  FOR Z = 1 TO 20: FOR I = 0 TO
     3:SH%(Z,I) = 0
430  NEXT I,Z:LS = 1: GOTO 80
440  TEXT : END
450  IF SL THEN  PRINT "** TABLE
     LOADED ERR": GOTO 80
460 SL = 1
470  PRINT "BLOADSHAPE" MID$ (A$,
     2, LEN (A$) - 1)
480  GOTO 80
490  FOR I = 768 TO 1000: POKE I,
     0: NEXT :SL = 0: GOTO 410
```

Apple II light pen

A NEW light pen for the Apple II is now available from U-Microcomputers of Warrington, Cheshire. The 3G Pen uses the game I/O socket and costs £35 plus VAT. The light pen can be used to program in Basic without the use of the keyboard with a single PEEK detecting the presence of light.

It is complete with instructions and a sample program on cassette. More details on (0925) 54117/8 from Dr Bill Unsworth.

Applecalls

APPLE decimal locations are converted to Hex ones and vice versa with this program writes TG Abrahams of Bristol. The program is named Applecalls and is written in Applesoft and I have used high line numbers so that it can be loaded before developing a program at lower line numbers, i.e., noting the last line number of main program typing RUN 63000, then typing '0' to quit, then LIST 0 — last line number of main program.

```
LOAD APPLE CALLS
]LIST

63000  HOME
63002  VTAB (6): HTAB (5): PRINT
     " WHAT IS REQUIRED ?."
63004  PRINT : PRINT " HEX TO BAS
     IC CALL'S (A)"
63006  PRINT : PRINT " OR BASIC C
     ALL'S TO HEX (B)"
63008  PRINT : PRINT "    (TYPE '
     0' TO QUIT)"
63010  PRINT
63012  INPUT " ANSWER 'A' OR 'B'
     ";A$
63014  IF A$ = "A" THEN 63022
63016  IF A$ = "B" THEN 63056
63018  IF A$ = "0" THEN  END
63020  GOTO 63000
63022  HOME
63024  VTAB (10): HTAB (12): PRINT
     " HEX TO PEEK AND POKE'S"
63026  PRINT : PRINT : PRINT
63028  INPUT "HEX EXPRESSION ? ";
     H$
63030  IF H$ = "0" THEN  END
63032  PRINT : GOSUB 63040
63034  IF E = 1 THEN  PRINT " THA
     T'S NOT HEX!": PRINT : GOTO
     63028
63036  IF T > 32767 THEN T = (T -
     65536)
63038  PRINT H$" IN HEX IS ";T;"
     IN APPLE DECIMAL": PRINT : GOTO
     63028
63040 T = 0:E = 0:X = 1
63042  FOR I =  LEN (H$) TO 1 STEP
      - 1
63044 H =  ASC ( MID$ (H$,I,1)) -
     48: IF H > 9 THEN H = H - 7
63046  IF (H < 0 OR H > 15) THEN
     E = 1: RETURN
63048 T = T + (H * X)
63050 X = X * 16
63052  NEXT I
63054  RETURN
63056  HOME
63058  INPUT " ENTER APPLE DECIMA
     L ? ";T:Y = T
63060  IF T <  - 32768 OR T > 327
     67 THEN  PRINT " OUT OF RANG
     E": GOTO 63058
63062  IF T = 0 THEN  END
63064  IF T < 0 THEN T = 65536 +
      T
63066  GOSUB 63072
63068  PRINT : PRINT Y" IN APPLE
     DECIMAL IS ";H$;" IN HEX": PRINT
63070  GOTO 63058
63072 H$ = "":X = 4096
63074 H =  INT (T / X):T = T - (H
      * X)
63076 H = H + 48: IF H > 57 THEN
     H = H + 7
63078 H$ = H$ +  CHR$ (H)
63080 X = X / 16: IF X < 1 THEN  RETURN
63082  GOTO 63074
]
```

• Circle No. 176

Clear representation

THE Teletype 43 printer cannot print Pet graphics, cursor symbols, pi or a left-pointing arrow. In many cases it leaves no space for unprintable characters to be inserted by hand, writes Kenneth Key of South Gwent.

There are printers which print cursor symbols but they reproduce so badly in literature as to be indecipherable.

Petchprogtop produces listings in which unprintable characters are represented clearly. Programs may be entered into the Pet from the listings without having to think what the cursor symbols mean or to remembr that they have not been printed.

The program has two modes, graphics and lower-case. In the graphics mode, all graphics are represented by the characters which would have been obtained by not pressing the shift key. They are enclosed in curly brackets and preceded by shift. So when entering a program, it is unnecessary to know the keyboard positions of unfamiliar characters.

Consecutively-repeated characters are counted and printed only once, followed by the count in square brackets.

That is an advantage for graphics but can lead to some strange listings of mixed upper- and lower-case letters with double letters. Some people may prefer that since

shift on a Pet is in the opposite sense to a typewriter.

The lower-case mode prints lower-case normally and does not count repeated letters although it does count repeated symbols. Figure 1 shows a listing of the program in lower-case mode: Figure 2 shows a short section in graphics mode.

The program to be listed must be saved as data in an ASCII file on cassette by typing

OPEN1,1,1:CMD1:LIST

When the motor stops and the cursor winks, the last incomplete bufferfull must be recorded by typing CLOSE1.

Two bugs have held up the development of the program. Firstly, the Pet does not write inter-block gaps when listing to the cassette. The occasional block may be lost if the motor runs on into it.

Secondly, cursor right does not always list on to the tape. The rules which govern that have not been discovered, but it appears that the first occurrence of cursor right is not always listed.

If a dummy line

0 PRINT "rgt"

is placed at the head of the program, all subsequent cursor rights will be listed correctly.

Method of retrieval

AS A relative newcomer to programming, I am always on the lookout for any routine which might prove useful at some later date — routines such as the retrieval of lost data. You may be interested in my method of retrieval which differs from that published in the May, 1980 issue writes Ben Enran of Waterford, Eire.

I had written an accounts-receivable program which was used by a friend faultlessly until one day he pressed play and record when prompted to press play. He did not realise that for some seconds, at which stage the damage was done.

My recovery was as follows: I re-wound the cassette fully; I wrote an open-to-write header, e.g., 10 OPEN 1, 1, 1, ran it,

(continued on next page)

Figure 1.

```
0 PRINT""
100 PRINT"clrPETCHPROGTOP2":POKE59468,14
110 PRINT"dwnAUTHOR K.A.Key. 1/80 4/80",,,,"South Gwent College"
120 PRINT"dwnspc[3]This program lists programs"
130 PRINTTAB(4)"with PET characters on a",,SPC(7)"TELETYPE 43 printer"
144 PRINT"dwnIf your program has",,,"cursor right characters"
145 PRINT"you should make the first line"
146 PRINT"dwnspc[13]0 PRINT";CHR$(34);"rgt";CHR$(34)
147 PRINTTAB(21)"---"
150 PRINT"rgt[2]You will need a program tape","rgt[2]saved as data by typing"
170 PRINT"rgt[3]dwn OPEN1,1,1:CMD1:LIST'"
180 PRINT"dwnDON'T FORGET to CLOSE 1",,"when cassette motor stops"
200 PRINT"dwn PRESS ANY KEY TO CONTINUE"
210 GETA$:IFA$=""THEN210
211 PRINT"clrdwn[7]Put tape in cassette #1"
213 PRINT"dwn[6]If your program has lower case",,"type 'L'"
214 PRINT"dwn[2]IF GRAPHICS, TYPE 'G'
215 GETC$:IFC$=""THEN215
217 IFC$="G"THEN220
219 IFC$<>"L"THEN211
220 PRINT"clrdwn[19]":OPEN1,4:OPEN2,1,0:PRINT#1,"dwn[2]":B$="":N=0:G=0
250 GET#2,A$:IFA$=""THEN250
260 IFST=64THENSTOP
280 PRINTA$;:IFA$=CHR$(13)THENGOSUB480:GOSUB570:PRINT#1,:GOTO250
289 IFA$=CHR$(160)THENA$=" "
290 IFASC(A$)>32ANDASC(A$)<95THEN300
292 IFC$="G"THEN330
295 IFASC(A$)>192ANDASC(A$)<219THEN300
297 GOTO330
300 GOSUB480:GOSUB570:PRINT#1,A$;:GOTO250
330 IFA$=B$THENN=N+1:GOTO250
350 GOSUB480:B$=A$:N=1
360 IFA$="up"THENGOSUB570:GOSUB610:PRINT#1,"up";:GOTO250
370 IFA$="dwn"THENGOSUB570:GOSUB620:PRINT#1,"dwn";:GOTO250
380 IFA$="rgt"THENGOSUB570:GOSUB620:PRINT#1,"rgt";:GOTO250
390 IFA$="lft"THENGOSUB570:GOSUB620:PRINT#1,"lft";:GOTO250
400 IFA$="hme"THENGOSUB570:GOSUB620:PRINT#1,"hme";:GOTO250
410 IFA$="clr"THENGOSUB570:GOSUB620:PRINT#1,"clr";:GOTO250
420 IFA$="rvs"THENGOSUB570:GOSUB620:PRINT#1,"rvs";:GOTO250
430 IFA$="rof"THENGOSUB570:GOSUB620:PRINT#1,"rof";:GOTO250
435 IFA$="stp"THENGOSUB570:GOSUB620:PRINT#1,"stp";:GOTO250
440 IFA$="pi"THENGOSUB570:GOSUB610:PRINT#1,"pi";:GOTO250
445 IFA$="<"THENGOSUB570:PRINT#1,"<";CHR$(8);"-";:GOTO250
450 IFA$=" "THEN250
455 IFG<>0THEN476
460 GOSUB640:PRINT#1,"shft";:GOSUB600:PRINT#1,CHR$(123);:G=1
476 PRINT#1,CHR$(ASC(A$)-128);:GOTO250
480 IFB$=""THEN560
485 IFB$=" "THEN490
487 IFN=1THEN560
488 GOTO520
490 IFN=1THENPRINT#1," ";:GOTO560
510 GOSUB620:PRINT#1,"spc";
520 IFN>9THENN$=MID$(STR$(N),2,2):GOSUB640:GOTO550
530 N$=MID$(STR$(N),2,1):GOSUB620:GOTO550
550 PRINT#1,"[";N$;"]";
560 N=0:B$="":RETURN
570 IFG<>0THENGOSUB600:PRINT#1,CHR$(125);
590 G=0:RETURN
600 PRINT#1,CHR$(95);CHR$(8);:RETURN
610 PRINT#1,CHR$(95);CHR$(95);CHR$(8);CHR$(8);:RETURN
620 PRINT#1,CHR$(95);CHR$(95);CHR$(95);
630 PRINT#1,CHR$(8);CHR$(8);CHR$(8);:RETURN
640 PRINT#1,CHR$(95);CHR$(95);CHR$(95);CHR$(95);
650 PRINT#1,CHR$(8);CHR$(8);CHR$(8);CHR$(8);:RETURN
READY.
```

Figure 2.

```
0 PRINT""
100 PRINT"clrPETCHPROGTOP2":POKE59468,14
110 PRINT"dwnAUTHOR K.A.Kshft{EY}. 1 80 4.80",,,,"Sshft{OUTH }Gshft{WENT }Cshft{OL[2]EGE}"
120 PRINT"dwnspc[3]Tshft{HIS PROGRAM LISTS PROGRAMS}"
130 PRINTTAB(4)"shft{WITH }PET shft{CHARACTERS ON A}",,SPC(7)"TELETYPE 43 shft{PRINTER}"
144 PRINT"dwnIshft{F YOUR PROGRAM HAS}",,,"shft{CURSOR RIGHT CHARACTERS}"
145 PRINT"shft{YOU SHOULD MAKE THE FIRST LINE}"
146 PRINT"dwnspc[13]0 PRINT";CHR$(34);"shft{RGT}";CHR$(34)
147 PRINTTAB(21)"---"
150 PRINT"rgt[2]Yshft{OU WIL[2] NE[2]D A PROGRAM TAPE}","rgt[2]shft{SAVED AS DATA BY TYPING}"
170 PRINT"rgt[3]dwn OPEN1,1,1:CMD1:LIST "
180 PRINT"dwnDON'T FORGET shft{TO }CLOSE 1",,"shft{WHEN CAS[2]ET[2]E MOTOR STOPS}"
200 PRINT"dwn PRESS ANY KEY TO CONTINUE"
210 GETA$:IFA$=""THEN210
211 PRINT"clrdwn[7]Pshft{UT TAPE IN CAS[2]ET[2]E }#1"
213 PRINT"dwn[6]Ishft{F YOUR PROGRAM HAS LOWER CASE}",,"shft{TYPE }'L'"
214 PRINT"dwn[2]IF GRAPHICS, TYPE 'G'
215 GETC$:IFC$=""THEN215
217 IFC$="G"THEN220
219 IFC$<>"L"THEN211
220 PRINT"clrdwn[19]":OPEN1,4:OPEN2,1,0:PRINT#1,"dwn[2]":B$="":N=0:G=0
250 GET#2,A$:IFA$=""THEN250
260 IFST=64THENSTOP
280 PRINTA$;:IFA$=CHR$(13)THENGOSUB480:GOSUB570:PRINT#1,:GOTO250
289 IFA$=CHR$(160)THENA$=" "
290 IFASC(A$)>32ANDASC(A$)<95THEN300
292 IFC$="G"THEN330
295 IFASC(A$)>192ANDASC(A$)<219THEN300
297 GOTO330
300 GOSUB480:GOSUB570:PRINT#1,A$;:GOTO250
330 IFA$=B$THENN=N+1:GOTO250
350 GOSUB480:B$=A$:N=1
360 IFA$="up"THENGOSUB570:GOSUB610:PRINT#1,"shft{UP}";:GOTO250
370 IFA$="dwn"THENGOSUB570:GOSUB620:PRINT#1,"shft{DWN}";:GOTO250
380 IFA$="rgt"THENGOSUB570:GOSUB620:PRINT#1,"shft{RGT}";:GOTO250
390 IFA$="lft"THENGOSUB570:GOSUB620:PRINT#1,"shft{LFT}";:GOTO250
400 IFA$="hme"THENGOSUB570:GOSUB620:PRINT#1,"shft{HME}";:GOTO250
410 IFA$="clr"THENGOSUB570:GOSUB620:PRINT#1,"shft{CLR}";:GOTO250
420 IFA$="rvs"THENGOSUB570:GOSUB620:PRINT#1,"shft{RVS}";:GOTO250
430 IFA$="rof"THENGOSUB570:GOSUB620:PRINT#1,"shft{ROF}";:GOTO250
435 IFA$="stp"THENGOSUB570:GOSUB620:PRINT#1,"shft{STP}";:GOTO250
440 IFA$="pi"THENGOSUB570:GOSUB610:PRINT#1,"shft{PI}";:GOTO250
445 IFA$="<"THENGOSUB570:PRINT#1,"<";CHR$(8);"-";:GOTO250
450 IFA$=" "THEN250
455 IFG<>0THEN476
460 GOSUB640:PRINT#1,"shft{SHFT}";:GOSUB600:PRINT#1,CHR$(123);:G=1
476 PRINT#1,CHR$(ASC(A$)-128);:GOTO250
480 IFB$=""THEN560
485 IFB$=" "THEN490
487 IFN=1THEN560
488 GOTO520
490 IFN=1THENPRINT#1," ";:GOTO560
510 GOSUB620:PRINT#1,"shft{SPC}";
520 IFN>9THENN$=MID$(STR$(N),2,2):GOSUB640:GOTO550
530 N$=MID$(STR$(N),2,1):GOSUB620:GOTO550
550 PRINT#1,"[";N$;"]";
560 N=0:B$="":RETURN
570 IFG<>0THENGOSUB600:PRINT#1,CHR$(125);
590 G=0:RETURN
600 PRINT#1,CHR$(95);CHR$(8);:RETURN
610 PRINT#1,CHR$(95);CHR$(95);CHR$(8);CHR$(8);:RETURN
620 PRINT#1,CHR$(95);CHR$(95);CHR$(95);
630 PRINT#1,CHR$(8);CHR$(8);CHR$(8);:RETURN
640 PRINT#1,CHR$(95);CHR$(95);CHR$(95);CHR$(95);
650 PRINT#1,CHR$(8);CHR$(8);CHR$(8);CHR$(8);:RETURN
READY.
```

(continued from previous page)

allowing sufficient time for it to be recorded and stopped the tape.

I then re-wound the cassette and wrote a small read program,

```
10 OPEN 1
20 FOR A = 1 TO 100
30 INPUT#1, A$: PRINT A$: NEXT A
```

The format of my "a/c rec" program used just seven variables, some string and some numerical, and as soon as seven or so had been retrieved, I stopped the tape. I then amended temporarily my "a/c rec" program to ignore the first two variables on the tape — they were, in fact, the last two of the invoice set — and then contained as normal.

The balance was then retrieved successfully with the lost of details of just nine invoices.

List-proof programs

ONE DAY, while happily tinkering inside my Pet monitor, the thought struck me: "What would happen if — "? The result produces list-proof programs writes Robert Acraman of Ruislip in Middlesex.

On power-up, enter the following program:

```
10 FOR X = 1 TO 10
20 PRINT X
30 NEXT
```

Now enter a line that gives nothing away with as low a line number as possible, e.g., Ø REM. The next step is to enter the monitor.

With new ROMs, the command is SYS 64785. For old ROMs, enter M Ø4ØØ Ø42Ø. That will display the Basic program as it is held in the Pet memory. The display should look something like this:

```
SYS 64785
C*
        PC    IRQ   SR  AC  XR  YR  SP
.;      C6FB  E62E  34  37  38  35  FA
.M Ø4ØØ Ø42Ø
.: Ø4ØØ ØØ Ø7 Ø4  ØØ  ØØ  8F  ØØ  13
.: Ø4Ø8 Ø4 ØA ØØ  81  58  B2  31  A4
.: Ø41Ø 31 3Ø ØØ  1A  Ø4  14  ØØ  99
.: Ø418 58 ØØ 2Ø  Ø4  1E  ØØ  82  ØØ
.: Ø42Ø ØØ ØØ AA  AA  AA  AA  AA  AA
```

On the first line (Ø4ØØ), the second and third pair of numbers hold the starting location of the next Basic line in reverse order, i.e., the next Basic line starts at Ø4Ø7.

When a program is listed, those links are used to tell the computer where to go next, so if it points to itself, i.e., Ø4Ø1, take the cursor over the Ø7 and change it to Ø1. Leave the monitor ("X") and list. Trying to list after line Ø, i.e., list 1Ø-, entering a line after line Ø and deleting line Ø succeed only in crashing the Pet.

Entering a line before the listable line will make the program listable once more. By setting the pointer to somewhere else in the Pet memory, perhaps some message could be printed.

Note that during running, the pointers are not used, so a list-proof program will still run. To make a program listable once more, simply re-set the pointer to Ø7. When LOADed from tape, the program will still be list-proof since the pointers are saved as well as the text.

I may as well take this opportunity to say congratulations on a great magazine. With your present standard and price, I can see myself continuing to buy it for a long time. Keep up the good work.

Scroll controller

WHEN printing the contents of a large array, whether within a running program or when debugging in immediate mode, it is often desirable to be able to start and stop the scrolling by means of a single keystroke writes Derek Haslam of Colne in Lancashire. The following method may be used: enter the program:

```
10 DIM A(1000)
20 FOR I = 1 TO 1000: A(I) = I: NEXT
30 FOR I = 1 TO 1000: PRINT A(I): WAIT
   158,1: NEXT
```

Lines 10 and 20 load the array with numbers. Line 30 prints them out again. However, you will find that only the first number is printed until you press a key. Printing will then continue until another key is pressed and so on. 158 is the address of the index for the keyboard queue — on new Pets: on old ones it is 525.

The wait statement in line 30 halts processing until the least significant bit, bit 0, of the contents of 158 becomes set. That will occur when the queue contains one character. Pressing a second key makes the contents of 158 = 2 so that bit 1 is set but bit 0 becomes 0 again.

That will continue with further keystrokes, the wait halting the program whenever the queue contains an odd number of characters. Going beyond 10 does not cause a system crash as the Pet manual implies — the queue appears to start filling from the bottom again and 158 goes back to 0.

Pet news

"IS THE Pet a money maker"? asked one very young enthusiast the other day. A good question which prompted a quick look at some of the zanier money making schemes dreamed up by Pet users writes Julian Allason.

Leaving aside the high-risk, but potentially rewarding, business of software publishing and normal commercial applications, one encounters an extaordinary mixture of British inventiveness and loony get-rich-quick schemes.

During the week, Matthew Wauchope is the pinstriped manager of a microsoftware house — something of a specialist on stock control and information management. On Saturday, he dons a gold earring, climbs into his gypsy boots and Romany Roger's famous fortune-telling computer is back on the fete and funfair circuit.

Having crossed Romany Roger's palm with silver and had the date and place of birth fed into the Pet, the punter watches as what is described as a genuine cybernetic horoscope is printed-out. It is complete with mysterious occult signals — a novel use of the Pet graphics. My horoscope included the immortal line: "A tall dark stranger will whisk you off your feet". I very much hope not.

John Minshull is an expert on coins, and runs a coin business in Lancashire. He has another obsession — the football pools. With the Pet, that old dream of receiving the pools cheque from Diana Dors, suddenly took on a whole new lease of life. Minshull spent a year on his Micropools program, and since then he has had a number of wins. Nothing enormous, but enough to pay for some Pet peripherals.

In the interests of increasing Pet fun rating, Minshull decided to publish the program. Micro-pools is available from Pet dealers price £20, or call 021-455 8585 for details.

Cursor function

I THINK that I have finally found a good use for the Pet cursor function POS (Ø) writes Brian Sweeting of Hazlemere, Buckinghamshire.

The old problem is displaying information of varying length in the same screen location without overlap from a previous longer item.

The usual solution is to provide a line of blanks before a new display in exactly the proper place to erase the old data. The solution using POS (Ø) is to print to the screen as usual but with a semicolon after the data string, then to find the end of the new line with POS(Ø). A for/next loop can then be instigated to print blanks along the rest of the line.

With the routine, all unwanted display in a program can be erased with the use of a one-line subroutine.

```
100 REM***USE OF 'POS(0)' FUNCTION***
120 REM***B$ WILL END AS 'A'***
140 REM***C$ WILL END AS 'ZZZZ ETC'***
160 A$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
180 PRINT"□"     :REM***CLEAR SCREEN***
200 FOR J = 26 TO 1 STEP -1
220 B$=LEFT$(A$,J)
240 C$=RIGHT$(A$,J)
260 PRINTB$;:GOSUB360
280 PRINTC$;
300 PRINT"ΠΠ"    :REM***KEEP DISPLAY ON SAME LINE***
320 NEXT
340 END
360 X = POS(0):FOR Y = X TO 40:PRINT" ";:NEXT:RETURN
READY.
```

We have had so many requests for advice about software for the little ZX-80 that we have decided to start a club page devoted to the machine. If you have a contribution to make, write to *Practical Computing* marking your letter ZX-80 Line-up. We pay £5 for contributions published.

Memory expansion board

EVEN at the most pessimistic estimate, memory expansion boards should now be arriving through readers' letterboxes writes Bob Maunder of Middlesborough. I have had the opportunity to use a prototype and was very impressed with the capabilities it gives the system.

The board I used consisted of six 2114 integrated circuits — the same chips as on the main ZX-80 board — plus decoding. It plugged straight on to the back edge-connector of the ZX-80. However, £60 seems rather expensive for the full 3K expansion, considering what it consists of — perhaps we can look forward to a drop in price soon.

Character manipulation

THE ZX-80 has been criticised for its poor character-handling facilities. Certainly there are several features which are notable by their absence, and others present but unusual.

A string of characters may be of any length and may be referred to by a letter followed by a dollar sign, i.e., A$, B$, ... Z$. A character may be any of the symbols on the ZX-80 keyboard, apart from the quotation mark, and others may also be fiddled — see August, 1980 ZX-80 Line-up for the inverse video routine.

The characters are stored by means of numerical codes in single bytes, i.e., 0 to 255 — a list of such codes appears in the ZX-80 operating manual.

The ZX-80 has several functions by which characters can be manipulated. They are:

- CODE, string — gives the code of the first character of the string, e.g., CODE ("ABC") is 38.
- TL$, string — removes the first character of the string, e.g., TL$, ("ABC") is "BC"
- CHR$, numerical expression — gives the character whose code is the value of the numerical expression, e.g., CHR$ (38) is "A".
- STR$, numerical expression — supplies the value of the expression in character form, e.g., STR$ (39) is "39".

Note that 39 is stored as 0010 0111 0000 0000 while "39" is stored as 0001 1111 0010 0101. A string variable may be initialised either using a LET or an INPUT statement, e.g.,

```
LET P$ = "A12,*"
```

Strings are not treated as arrays and do not need to be DIMensioned. Also there is no length function available for strings — the LEN of other Basics. That, need not, however, be a great problem.

The following abbreviation of coding in the ZX-80 manual illustrates how a string X$ may be printed in inverse video, using the fact that inverse characters have codes 128 greater than their normal equivalents.

```
500▽IF▽A$ = ""▽THEN▽RETURN
510▽PRINT▽CHR$(CODE(A$)+128);
520▽LET▽A$=TL$(A$)
530▽GO▽TO▽500
```

The routine uses the concept of the null string — very important in ZX-80 character handling. The null string or " " is the same as CHR$(1) or quote, because of the way that characters are stored in memory, and it is used to test for the end of a string as shown before.

Many computers provide simple means by accessing substrings, parts of string, either by means of string arrays and subscripts, or by means of functions such as LEFT$, MID$ and RIGHT$. The ZX-80 has no such facilities, but by holding character codes in numerical arrays, such features may be simulated.

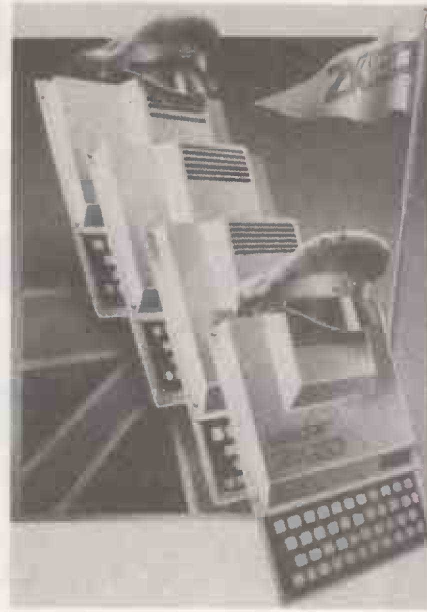
This program invites the user to input a word of up to 25 characters in length. The user then enters two numbers corresponding to the first and last characters of the substring to print.

```
10 DIM A (24)
20 PRINT "ENTER WORD";
30 INPUT A$
40 IF A$="" THEN GO TO 30
50 PRINT A$
60 FOR I=0 TO 24
70 LET A(I)=CODE(A$)
80 LET A$=TL$(A$)
90 IF A$="" THEN GO TO 110
100 NEXT I
110 PRINT "ENTER NUMBER OF
FIRST LETTER"
120 PRINT "TO BE PRINTED";
130 INPUT N1
140 IF N1 < 1 or N1 >25 THEN GO TO 130
150 PRINT N1
160 PRINT "ENTER NUMBER OF LAST
    LETTER
170 PRINT "TO BE PRINTED
180 INPUT N2
190 IF N2<N1 OR N1 > 25 THEN GO TO
    180
200 PRINT N2
210 PRINT "SUBSTRING"=";
220 FOR I=N1-1 TO N2-1
230 PRINT CHR$(A(I));
240 NEXT I
```

For example, we may have:

```
ENTER WORD ELEPHANT
ENTER NUMBER OF FIRST LETTER
TO BE PRINTED
3
ENTER NUMBER OF LAST LETTER
TO BE PRINTED
8
SUBSTRING=EPHANT
```

Holding several individually-accessible words in an array is more difficult, but still possible. This program holds the codes for five input words in array C, while array S holds pointers to the start of the words and array E to the end.



```
10 LET I=0
20 DDM C(49)
30 DIM S(4)
40 DIM E(4)
50 FOR J=0 TO 4
60 PRINT "ENTER WORD";
70 INPUT W$
75 PRINT W$
80 LET S(J)=I
85 IF I 49 THEN GO TO 220
90 LET C(I)=CODE(W$)
100 LET I=I+1
120 LET W$=TL$(W$)
130 IF NOT W$="" THEN GO TO 85
140 LET E(J)=I-1
150 NEXT J
155 RANDOMISE
160 LET R=RND(5)
170 PRINT "WORD ";R;"=";
180 FOR J=S(R-1) TO E(R-1)
190 PRINT CHR$(C(J));
200 NEXT J
210 STOP
220 PRINT "TOO MANY LETTERS"
```

Program economy

WE NOW turn to look at how logical values of true and false may be used to economise on program size. The ZX-80 represents true by all ones, e.g., if we have, LET B=(A=A), B will appear in memory as 111 111 111 111 or, using two's complementation, -1.

Similarly, false is held as all zeroes, or 0. A conditional if statement of the form, IF expression THEN instruction, results in the instruction part being executed providing the expression does not evaluate to -1.

In fact, we find that if statements may be reduced to a minimum using logical values in LET statements. Consider the following problem: We want to set Z to 71 if A equals 0, to 39 if A equals 1, or to 50 if A is any other value. That may be done by a single assignment statement:

LET Z=-17*(A=0)-39*(A=1)-50*(A O OR A 1). If it is seen that the conditions will evaluate to 0 if they are false, and only the true condition will give -1, it becomes clear why this works.

Cursor drawings

AS A follow-up to his comments about drawing on the Tandy in the August, 1980 issue, Ken Smith has sent us this program to enable you to draw pictures on the screen with the cursors. The program is self-explanatory.

```
10 ' THE MAIN PROGRAM STARTS AT LINE 300
20 ' THOSE WHO DON'T WISH TO TYPE INSTRUCTIONS
30 ' MAY START THERE WITHOUT ANY PROBLEMS.
40 CLS:PRINT:PRINT:PRINTCHR$(23);TAB(12);"DRAW"
50 PRINTTAB(12);"===="
60 PRINT:PRINT:PRINT
70 PRINTTAB(5);"BY KEN B SMITH"
8- PRINT:PRINT:PRINT:PRINT"   DO YOU WANT INSTRUCTIONS";:INPUTZ$
90 IFLEFT$(Z$,1)="N"THEN300
100 CLS:PRINTTAB(15)"DRAW INSTRUCTIONS
110 PRINTTAB(15)"=================
120 PRINT"   THIS PROGRAM WILL LET YOU DRAW ANY DESIGN OF YOUR CHOICE
130 PRINT"ON THE SCREEN. YOUR CONTROLS ARE AS FOLLOWS:-"
140 PRINT"THE CURSOR ARROWS MOVE THE LINE IN THE NATURAL SENSE.
150 PRINT"ALSO COMBINATIONS WILL PRODUCE A DIAGONAL LINE.
160 PRINT"  YOU CAN HAVE A POSITIVE OR NEGATIVE DRAWING. TO
170 PRINT"CHANGE THE FORMAT PRESS '1' AT ANY TIME IN THE RUN.
180 PRINT"   HITTING THE 'ENTER' WILL ERASE THE SCREEN AND LEAVE THE
190 PRINT"START POINT AT THE LAST POSITION. SO ALLOWING YOU TO
200 PRINT"BEGIN AT ANY POINT ON THE SCREEN.
210 PRINT"   HITTING THE SPACE BAR WILL FLASH THE CURSOR AND ALLOW YOU
220 PRINT"TO MOVE IT ANYWHERE WITHOUT A PRINT. TO EXIT FROM THIS
230 PRINT"PRESS THE SPACE BAR AND UP ARROW TOGETHER.
240 PRINT"  PRESS ENTER TO CONTINUE......";:INPUTX:CLS
250 PRINT:PRINT:PRINT:PRINT"   YOU MAY ALSO LET THE 'TRS-80' DO THE DRAWING, EITHER BY
260 PRINT"ENTERING '2' NOW OR BY PRESSING A '2' AT ANY TIME IN THE RUN.
270 PRINT"  YOU MAY PAUSE THE PROGRAM BY HITTING 'SHIFT @ '.
280 PRINT"PRESS ENTER TO CONTINUE......";:INPUTX
290 IFX=2GOTO890
300 X=63:T=23:'X & Y CO-ORDS FOR THE CENTER OF THE VDU
310 CLS
320 SET(X,Y):' PUT A DOT IN THE CENTER
329 'FLASH DOT, CHECKS KEYBOARD, SETS FLAG (Z) IF ERASE REQ.
330 RESET(X,Y):SET(X,T):A=PEEK(14426)/8:IFA=16THENZ=1
340 IFA=17THENZ=0:'CHECKS IF DRAW REQ.
350 IFZ=1THENSET(X,Y):RESET(X,Y):GOTO420:'ERASE PLEASE
360 A=PEEK(14426)/8:'CHECK KEYBOARD AGAIN
370 IFA=0GOTO330:'NOTHING? GO BACK AND TRY AGAIN
380 IFA=.125GOTO310:'<ENTER>? SO GO BACK AND CLEAR SCREEN
390 IFA=.25GOTO600:'<1> CHANGE THE FORMAT TO NEGATIVE
400 IFA=.5GOTO890:'<2> LET'S GO TO AUTO DRAWING
410 'SO WHICH WAY DO I MOVE THE DOT. SEE FIG.1
420 ONAGOTO440,460,330,480,500,520,330,540,560,580
430 GOTO330:'GO BACK IN CASE THERE WAS A CRAFTY ENTRY
440 IFY>0THENY=Y-1:GOTO330:'ALL THESE CHECK THAT WE STAY INSIDE
450 RESET(X,Y):GOTO330:'THE SCREEN AND DOUBLE FLASH ON BORDERS
460 IFY<47THENY=Y+1:GOTO330:'OR REVALUE X & Y AS REQUESTED
470 GOTO450
480 IFX>0THENX=X-1:GOTO330
490 GOTO450
500 IFX>0ANDY>0THENX=X-1:Y=Y-1:GOTO330
510 GOTO450
520 IFX>0ANDT<47THENX=X-1:T=Y+1:GOTO330
530 GOTO450
540 IFX<127THENX=X+1:GOTO330
550 GOTO450
560 IFX<127ANDY>0THENX=X+1:Y=Y-1:GOTO330
570 GOTO450
580 IFX<127ANDY<47THENX=X+1:Y=Y+1:GOTO330
590 GOTO450
600 FOHZ=15360TO16383:POKEZ,191:NEXT:'WHITEOUT SCREEN FOR NEG.
610 RESET(X,Y):'JUST THE REVERSE OF THE FIRST PART
620 SET(X,Y):RESET(X,Y):A=PEEK(14426)/8:IFA=16THENZ=1
630 IFA=17THENZ=0
640 IFZ=1THENRESET(X,T):SET(X,Y):GOTO710
650 A=PEEK(14426)/8
660 IFA=0GOTO620
670 IFA=.125GOTO600
680 IFA=.5GOTO890
690 IFA=.25GOTO300
710 ONAGOTO730,750,600,770,790,810,600,830,850,870
720 GOTO620
730 IFY>0THENY=Y-1:GOTO620
740 SET(X,Y):GOTO620
750 IFY<47THENY=Y+1:GOTO620
760 GOTO740
770 IFX>0THENX=X-1:GOTO620
780 GOTO740
790 IFX>0ANDY>0THENX=X-1:Y=Y-1:GOTO620
800 GOTO740
810 IFX>0ANDY<47THENX=X-1:Y=Y+1:GOTO620
820 GOTO740
830 IFX<127THENX=X+1:GOTO620
840 GOTO740
850 IFX<127ANDY>0THENX=X+1:Y=Y-1:GOTO620
860 GOTO740
870 IFX<127ANDY<47THENX=X+1:Y=Y+1:GOTO620
880 GOTO740
890 CLS:PRINT"TRS- 80 PICTURE. WOULD YOU LIKE A NEGATIVE OR A
900 PRINT"POSITIVE SCREEN?":'AUTO DRAW SECTION
910 PRINT:PRINT:'DOUBLE LINE FEED
920 PRINT"TYPE 'P' OR 'N'
930 Y$=INKEY$:IFY$=""GOTO930:'WATCH THE KEYBOARD !!
940 IFY$="N"GOTO1040
950 IFY$="P"GOTO970
960 GOTO930:'YOU MUST ANSWER YES OR NO
970 CLS
980 X=63:Y=23:'BACK TO THE MIDDLE
990 X=X+(RND(3)-2):Y=Y+(RND(3)-2):'RANDOM INCREMENTS OF X & Y
1000 IFX<1ORX>126GOSUB1110:'STAY INSIDE THE BOUNDERIES TO
1010 IFY<1ORY>46GOSUB1140:'AVOID A FC ERROR
1020 RESET(X,Y):SET(X,Y):Y$=INKEY$:IFY$="1"GOTO330:'FLASH
1030 GOTO990:'AFTER THE CHECK, START AGAIN
1040 FORZ=15360TO16383:POKEZ,191:NEXT
1050 X=63:Y=23:'IT'S THE MIDDLE AGAIN
1060 X=X+(RND(3)-2):Y=Y+(RND(3)-2):'RANDOM INCREMENTS AGAIN
1070 IFX<1ORX>126GOSUB1110:'X ERROR ABOUT TO HAPPEN ?
1080 IFY<1ORY>46GOSUB1140:'STOP THAT Y ERROR AS WELL
1090 SET(X,Y):RESET(X,Y):Y$=INKEY$:IFY$="1"GOTO330:'FLASH
1100 GOTO1060:'AND CHECK FOR A REQUEST.THEN START AGAIN
1110 IFX>126THENX=126:'GET X BACK TO A USEABLE VALUE
1120 IFX<1THENX=1:'EITHER FROM HIGH OR LOW
1130 RETURN:'AND THEN GET BACK
1140 IFY<1THENY=1:'AND THE SAME FOR THE Y VALUES
1150 IFY>46THENY=46
1160 RETURN
```

Helix program

THIS short program from Clive Lumb of York, is for drawing single and multiple helices:

```
10 CLS
20 INPUT "RADIUS CONSTANT,
   INCREMENT";A,U
30 INPUT "ASPECT RATIO (CIRCLE
   2.4)";E
40 CLS
50 N=0
60 N=N+U
70 X=64+A*N"COS(N)
80 Y=24+A*N*SIN(N)/E
90 X=INT(X+.5):Y=INT(Y+.5)
100 IF X > 127 OR Y > 47 OR X < 0 OR Y<
    0 GOTO 130
110 SET(X,Y)
120 GOTO 60
130 GOTO 130
140 END.
```

TANDY FORUM is devoted to the Tandy TRS-80. Sometimes we will use it to pass on news about the TRS-80 but, above all, it is for users, and would-be users, of the well-established model I and now the new model II. With your tips, queries, moans and comments, this page can become a market-place for TRS-80 information.

Best results are obtained using values of .5-10 for A and .1-1 for U, but, of course, experimentation is the watchword.

Microchess for Level II

READERS may be interested in a strategy which defeats the program at all three levels of skill writes Robin Watson of Walton on Thames, Surrey. It is for the TRS-80 Level II.

	White	*Black* (Computer)
1.	E2 — E4	E7 — E5
2.	D2 — D4	E5 — D4
3.	C2 — C3	D4 — C3
4.	F1 — C4	C3 — B2
5.	D1 — D5	B2 — A1
6.	D5 — F7	Checkmate: You win.

I would be interested to know if this strategy would be successful against the Pet Microchess program. In any case, could I put in a plea to Tandy for something a little more sophisticated? Thanks for an excellent magazine.

Screen and keyboard

I HAVE discovered some interesting points about turning the screen and keyboard on and off, writes Colin Barton of Bracknell, Berkshire. My findings are an expansion of Stephen Troop's mentioned in the October, 1979 issue.

Any single, double or three-digit number up to and including 255 which has an even second digit followed by either a 2,3,6,7 or Ø will turn on the screen. That will also work with an odd second digit followed by either a 1,4,5,8 or 9. Any other number turns off the screen. Here is a testing program:

```
1Ø CLS
2Ø POKE 16413,Ø
3Ø FOR L = 1 TO 255
4Ø POKE 16413,L
5Ø PRINT L; "TURNS THE SCREEN ON"
6Ø POKE 16413,Ø
7Ø NEXT
```

Any even number under 255 will turn off the keyboard. Any odd number will turn it back on. Again, here is a testing program:

```
1Ø CLS
2Ø ON ERROR GOTO 1ØØ
3Ø POKE 164Ø5,Ø
4Ø FOR L = 1 TO 255
5Ø POKE 164Ø5,L
6Ø FOR W = 1 TO 1ØØ
7Ø A$ = INKEY$
8Ø IF LEN (A$) Ø THEN PRINT L; "TURNS
   THE KEYBOARD ON"
9Ø NEXT W
1ØØ NEXT L
```

Press any key about every half second while the program is running.

Joystick and speed

HERE IS some help, from Peter Ashmore, of Neston, South Wirral, for anyone keen enough to delve around inside their TRS-80. The first item will enable you to give the Tandy joystick control. The second will increase the speed.

Here are a list of the parts required for joystick control:

8212 eight-bit I/O port
74LS00 quad two-input N and gate
Registor network 13×4.7K in one package Tandy Radio Spares 140-041
Edge connector one pitch, Radio Spares 467-021
Joystick Radio Spares 337-352 or five push-to-make switches
One metre of 20-way ribbon cable or longer

The first thing to do is modify the edge connector as Tandy uses a 40-way bus and the Radio Spares one is a 43-way — actually a 44-way but one pin is blanked-out. Count 20 contacts and then one more, then cut-off excess contacts, you should now have 21 contacts — counted along one side.

Now remove the pair of contacts at the end nearest the cut, insert in its place the blanking piece from the spare piece of edge connector. You should now have a 40-way edge connector. Check for fit on the TRS-80 at the back of the keyboard, mark one side of edge connector top so you do not connect it incorrectly after it is wired up.

(continued on next page)

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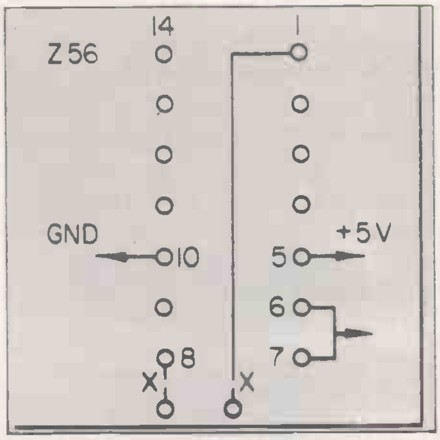
The circuit can now be constructed on whatever you choose, I used Veroboard. You can use a 4.5V Bell-type battery for the power supply or as I have done, take it from the edge connector on the TRS-80. The only problem is, on the Level II, that the five-volt out is connected to ground so you will have to remove the top from your keyboard and remove the link and reconnect the break in the print by the edge connector.

I do not recommend you to do that if you have a 16K memory, as mine is only 4K and I don't know how much extra the 16K ICs draw from the power supply. The joystick control draws about 50 milliamps, so if you have a 16K memory use the 4.5V battery.

Here is a test program:

```
10 CLS
20 X = INPØ
30 Print X:GOTO 20
```

This will show the decimal value when the joystick — or push-buttons — is operated in the required direction. It can then be noted and held for future use in programs, games, drawing programs, etc.



Rough view of the print side of the main board; break print at points marked **X**.

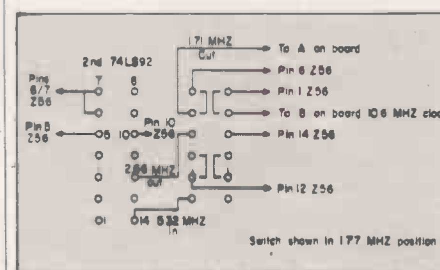
For a speed increase for the TRS-80 of 1.77MHz to 2.66MHz, the following parts are required:

74LS92 divide by six binary counter
Four-way change-over switch
One metre of 10-way ribbon cable

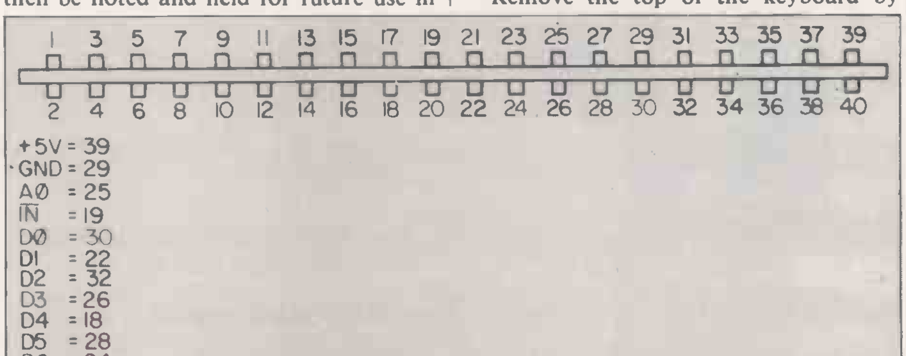
Remove the top of the keyboard by removing the five screws — note the lengths for replacing. Look to the bottom-right-hand corner, Z56 is the last integrated circuit in the corner. If you have a Level II, it is covered by the ROM board. Swing this out of the way, then following the diagram, link-up the ribbon cable to the print side of the integrated circuit.

The ribbon can be run to the back lower-left recess in the case — a convenient place to mount the switch and integrated circuit. Do not forget, always double-check solder joints and wiring for mistakes, as a solder splash across the print could be disastrous.

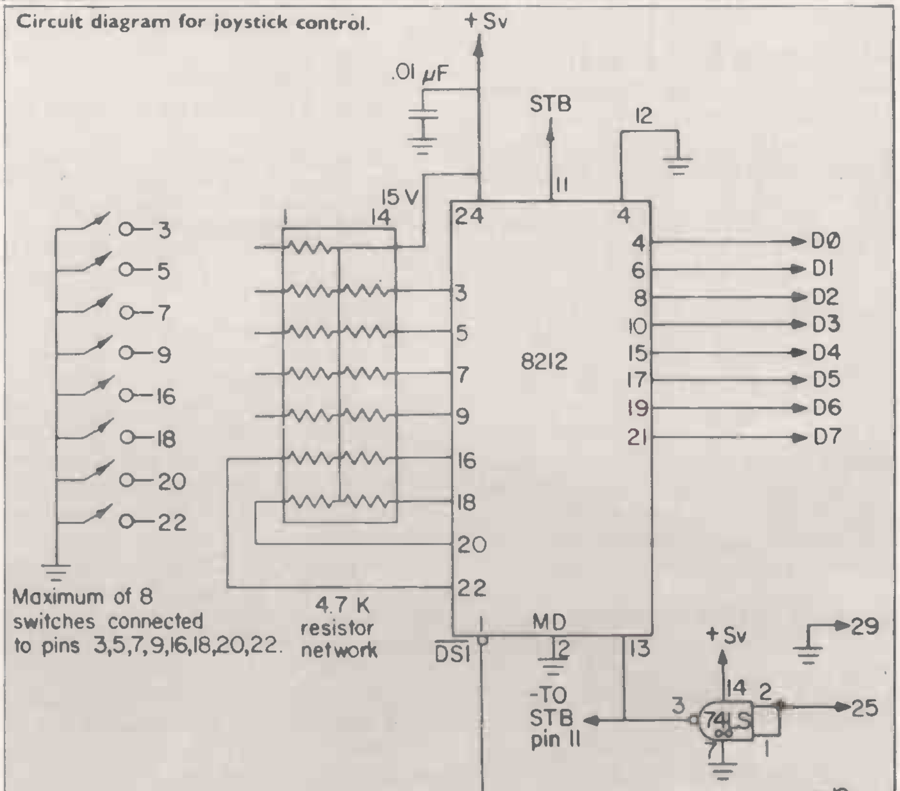
Old tapes will not load at new speed which is why the switch is necessary. Also



The switch shown in the 1.77MHz position.



The edge connector viewed from the rear of the keyboard.



Circuit diagram for joystick control.

if the switch is operated while on, the computer will lock-up and you will have to switch-off to regain control.

A handy one-line program to check that it is operating correctly is

```
10 for X = 15360 to 16383: poke X,191:
Next X: CLS: GOTO 10
```

Try at both speeds and notice the difference.

Faster data entry

HAVING BEEN anxious, like many others, to overcome the slow data entries to cassette, I have devised a program which enters directly into data statements, writes John Farrer of Via Lancaster. It works for one line of entries, up to 255.

I still have to solve the problem for several lines of data but have made one work at Z = Z + 10 after reaching a total of 255.

```
5 CLS
10 DATA—up to 255—(Letters or numerals)
11 INPUT "HOW MANY ENTRIES"; A
12 REM ALL the ABOVE IS RULE OF
   THUMB TO GET THE RIGHT
   "POKINGS" LATER
20 CLEAR 600
21 DIM A$ (30)
22 FOR P = 1 to A:INPUT "ENTER NOW"
   ;A$ (P)
40 X = LEN (A$(P)):PRINT X
41 REM PRINTING X JUST FOR CHECK
50 FOR I = 1 TO X
60 B£ = MID$(A$(P),I,1)
70 Y = ASC (B$)
80 POKE 17139 + Z + I,Y
90 NEXT
92 POKE 17140 + X + Z,44
94 Z = Z + X + 1
100 CLS
110 PRINT "THIS IS NOW IN DATA"
200 NEXT P
210 REM EXTRA POKE OF 44 PUTS A
    COMMA
    THIS WILL DO AN ENTRY TO FILL
    ONE LINE OF DATA
```

Formula One program

AN IMPORTANT aspect of any computer graphics game on the UK101 is moving considerable amounts of data round the screen writes Toby Walsh of Leighton on Sea in Essex. Basic is too slow in most cases and one is left to either program totally in machine code or using machine-code subroutine, both of which are tedious and time-consuming.

If we look more closely at Basic, we see that there is already a built-in command for moving data around the screen, namely the print command.

When a line feed is executed by a print statement, the screen scrowls up which is, in fact, every character being moved back 64 positions. In the Formula One program, a car is Poked into a position on the top of the screen and cars and barriers marking the sides of the course are scrowled up at you, until either you crash or you cross the finishing line.

Line numbers 100-180 are the instructions

180 POKE 11,0 : POKE 12, 253: X = USR(X)

This jumps to a subroutine pointed to by the contents of locations 11 and 12 which, in this case, waits for a character to be input from the keyboard before returning. 190-220 initialises all the variables and draws the barriers for the start of the game. 230-280 is the game itself. 230-250 allows you to move left or right within the constraints of the barriers — the keys used for that are the two large shift keys. 160 randomly Pokes a car at random intervals on the bottom line of the screen. 290-350 prints the loose message. 360-370 Pokes the finishing line on to the bottom line of the screen. 380-400 prints the win message. 410-470 deals with another go, and the goodbye message.

THE 6502 SPECIAL is dedicated exclusively to the exchange of information between 6502 users. It is up to you, the reader, to help establish this page with your ideas, problems and guidance for other 6502 users. Please mark your letters 6502 Special. We pay £5 for each contribution published.

```
10 REM  *********************************
20 REM  *****      FORMULA ONE      *****
30 REM  *****            14/5/80    *****
40 REM  *****       for the Compukit *****
50 REM  *****       to run in 4K    *****
60 REM  *********************************
100 FORA=1TO16:PRINT:NEXT
110 PRINT"                    FORMULA  ONE"
120 PRINT"                    ============"
130 PRINT:PRINT:PRINT"You are driving";
140 PRINT" a Formula One car at Brands"
150 PRINT"Hatch.Left shift moves you left";
160 PRINT" and right "
165 PRINT"shift moves you right"
170 PRINT:PRINT"                    Hit any key"
180 POKE11,0:POKE12,253:X=USR(X):K=57100:D=0
190 S=53281:B=54236:C=54247:SS=53261
200 FORA=1TO16:PRINT:NEXT:FORA=1TO15
210 POKESS+A*64-49,161:POKESS+A*64-38,161
220 NEXT
230 POKES,1:A=PEEK(K)
240 IFA=250ANDPEEK(S+63)=32THENS=S-1
250 IFA=252ANDPEEK(S+65)=32THENS=S+1
260 IFRND(1)>.4THENPOKEB+1+RND(1)*10,2
270 D=D+1:POKEB,161:POKEC,161:PRINT
280 IFPEEK(S)=32ANDD<200THEN230
290 IFPEEK(S)=61THEN380
300 IFD=200ANDPEEK(S)=32THEN360
310 FORA=1TO1000:NEXT:FORA=1TO16:PRINT:NEXT
320 PRINT "                    CRASH !!!!"
330 PRINT:PRINT
340 PRINT"                 Better luck next time"
350 GOTO420
360 FORA=1TO10:POKEB+A,61:NEXT:D=0
370 GOTO230
380 FORA=1TO1000:NEXT:FORA=1TO16:PRINT:NEXT
390 PRINT"                    You win":PRINT
400 PRINT:PRINT
420 INPUT"                   Another go";A$
430 IFLEFT$(A$,1)="Y"THENRUN
440 FORA=1TO16:PRINT:NEXT
450 PRINT "                     BYE "
460 FORA=1TO16:FORB=1TO500:NEXT:PRINT:NEXT
470 END
```

Variables

Numerical

A Loop variable
B Position of left barrier on bottom line
C Position of right barrier on bottom line
D Counter for time of play
K Location of keyboard
S Position of player's car
SS Position of top-left-hand corner of screen
X Argument

Strings

A$ Answer string to an input.

Re-sequencing lines

THE PROGRAM will re-sequence the line numbers in a Basic program on the Superboard or UK101, writes Michael Whittle of Oxford. It is designed to be left in memory above the program being developed, and called into action by RUN63000.

The program re-sequences the line numbers in 10s and corrects all GOTO and GOSUB instructions, including ON . . . GOTO and ON . . . GOSUB. It may be adapted for use on any Microsoft Basic by changing the value of AD to the address of the fourth byte of the Basic storage area.

The program is restricted by re-numbering 100 lines, although for computers with sufficient memory, that could be changed by corrections of the values in lines 63010, 63050 and 63060. If the program needs to write a label into a space which is too small, for example, changing GOTO5 to GOTO10, the line number is given for subsequent re-typing.

```
63000 REM RENUMBERING PROGRAM
63010 DIMA(100):AD=771:FORI=1TO100
63020 GOSUB63230:IFLN>62999THEN63060
63030 N=I*10!NH=INT(N/256):NL=N-256*NH
63040 POKEAD,NL:POKEAD+1,NH:A(I)=LN
63050 AD=NA:NEXTI:PRINT'OVER 100 LINES'
63060 AD=771:FORB=1TO100!GOSUB63230
63070 IFLN>62999THENPRINT'COMPLETE':END
63080 FORJ=AD+2TONA-4:C=PEEK(J)
63090 IFC<>136ANDC<>140ANDC<>160THEN63220
63100 L=PEEK(J+1):IFL<48ORL>57THEN63220
63110 C$='':FORK=J+1TOJ+8:C=PEEK(K)
63120 IFC<48ORC>57THEN63140
63130 C$=C$+CHR$(C):NEXTK
63140 L=VAL(C$):FORH=1TOI:IFA(H)=LTHEN63160
63150 NEXTH:PRINT'LIN';B*10;'LAB';L:GOTO63210
63160 N$=STR$(H*10):R=LEN(N$):FORX=2TOR
63170 POKEK+X-R-1,ASC(MID$(N$,X,1))!NEXTX
63180 IFK-R<JTHENPRINT'OVERWRITTEN LINE';B*10
63190 IFK-J-R<=0THEN63210
63200 J=J+1!POKEJ,32:GOTO63190
63210 IFC=44THENJ=K!GOTO63110
63220 NEXTJ!AD=NA:NEXTB:PRINT'INCOMPLETE':END
63230 NA=PEEK(AD-1)*256+PEEK(AD-2)+2
63240 LN=PEEK(AD+1)*256+PEEK(AD)!RETURN OK
```

Structured Cobol for data processing

By Norman Lyons, published by Glencoe Publishing Co Inc (1980) in the U.S. and by Collier Macmillan Ltd (1980) in the U.K. U.K. price £6.50. 325 pages paperback. ISBN 0-02-470770-8.

COBOL is probably still the most widely-used high-level programming language in the world. It is suited best to applications which involve a good deal of data manipulation and file access but which have limited amounts of calculation or logical complexity.

Most Cobol usage is found in commercial companies, in financial, order processing, management information or similar applications. Cobol is a very useful language to know if you want a career in data processing.

The book is designed to be used by students on organised programming courses, although it could be used for self-instruction by a determined reader, particularly if he had access to a computer with a Cobol compiler.

The version of Cobol taught is ANSI 74, somewhat simplified and, in one or two places, modified to conform more closely to IBM implementations.

The language is presented gradually, with the intention that programs can be written successfully early in the course. Maximum benefit from the approach can be gained only if the student has access to a simple data file in a defined format.

The exercises progress from retrieving information from the file, through updating the file, to more complex manipulations and creating new files. To assist in following that strategy, the publishers provide an instructors' manual and a copy of the assumed data file of 3,000 items to those who adopt the book as a text for a course.

The structured approach mentioned in the title reflects some emphasis on the use of single-entry-single-exit constructs sequence, if-then-else and do-while or their Cobol equivalents. The HIPO, Hierarchy plus Input-Process-Output, design technique is introduced briefly and flowcharts are used extensively.

Somehow, despite its June 1980 publication date, much of the text has a slightly dated air — as if it were written mostly in the early 1970s. Certainly far too little attention is paid to program design and to the importance of file-structure influencing program-structure, and of problem-structure influencing both.

Readers of the book would be well advised to read Michael Jackson's excellent Principles of program design, published by Academic Press in its APIC series, immediately afterwards.

Conclusions

- **Most valuable as a test book for a course built round the extra instructional materials.**
- **It is also reasonably useful as a general introduction to Cobol for data processing.**
- **Good value at £6.50.**

Machine language programming from the ground up and the secrets of ROM and RAM

By Hubert S Howe jr., published by A J Harding (Molimerx), available in the U.K. from the publisher. 147 pages paperback. £8.50.

THIS BOOK describes machine-language programming for the Z-80 microprocessor. Its bias is towards Tandy TRS-80 users, particularly those who have 16K or larger Level II machines, but much of the text is relevant to any Z-80-based system.

The description of the Z-80 follows a traditional pattern. Firstly, internal number and data formats are described; then the architecture of the Z-80 processor, its registers, instruction formats, flags, addressing modes and timings. Next, the full instruction set is described, succinctly but completely followed by the use of the stack.

Part two of the book, occupying the last two-thirds of the text, is called practical programming. The chapters in that part include reading and printing numbers, organising arrays and tables, moving data, searching, integer arithmetic, floating point arithmetic, and logic and bit operations.

Those topics are accompanied by many Z-80 assembler subroutine listings, which in themselves will repay the cost of the book by the hours saved through not having to re-invent them. The subprograms also provide valuable examples of assembler programming techniques and will help the reader to become familiar with the instruction-set.

The book has much to offer anyone wanting to learn Z-80 assembler, whether they own a TRS-80 or not. The TRS-80 owner is even more fortunate, since there is also a considerable amount of useful information here which is specific to TRS-80 systems.

The memory map for TRS-80 Level II basic systems is described, and a number of useful ROM addresses are given. With this information, the reader can, for example, use ROM subroutines to scan the keyboard and write to the video monitor. The use of the Tandy editor/assembler program is also described. There are also chapters on cassette input/output, disc input/output, USR subroutines in Basic, and the format on disc of TRSDOS directory and files.

That is a great deal of information to pack into 147 A5 pages, and the author does not waste words. The result is a reference book which is a joy to use. The newcomer will find it hard work, but the information is there, and study and experiment will be rewarded.

The one criticism is a matter of programming style. Some emphasis is given throughout the book to ways in which the odd byte or machine cycle can be saved, often at the expense of clarity and program maintainability. That has to be a mistake, since the newcomer to assembly code will have to labour for many months before 16K of RAM proves a serious constraint.

Where time or space is critical, it may be justifiable to indulge in clever tricks, but it is a bad programming style to teach to beginners and will cost a great deal of time to correct later.

Conclusions

- **A well-written and information-packed book, excellent for TRS-80 owners and valuable to anyone wanting to learn about the architecture and instructions of the Z-80.**
- **The many useful assembler subroutine listings may be themselves justify the cost of the book for many readers.**
- **It is strongly recommended.**

Learning Level II

By David A Lien, published by Compusoft Publishing (U.S.A.) 1979. 352 pages paperback, ISBN 0-932760-01-5. Available in the U.K. from NewBear Ltd and others price £11.

LEARNING Level II is a teaching manual for Tandy TRS-80 Level II Basic.

If you have just upgraded a Level I TRS-80 to Level II and you learned about Level I from the Level I users' manual and thought it excellent, this book is for you. David Lien is the author of the Level I manual, which Tandy supply with the TRS-80 model 1 systems, and Learning Level II continues in the same style.

There is even a section of the book devoted to updating the Level I manual, with new pages to insert where parts of the Level I text no longer hold true for Level II.

The main part of the text is a well-thought-out introduction to the new features of Level II Basic, with plenty of description and examples.

In addition to the description of Basic commands and statements, there is plenty of practical detail, covering the expansion interface, dual cassette systems, conversion of programs and data tapes from Level I to Level II, and various dire warnings about system design faults.

Conclusions

- **The book does for Level II TRS-80 Basic what the Level I user's manual did for Level I.**
- **Only for TRS-80 users, of course, and only then if you can accept the author's style.**

Martyn Thomas

September

●1 **APL on a micro seminars.** Venue: Newcastle upon Tyne. September 8, Birmingham; September 9, Preston; September 10, Watford; September 11, York; September 12, Glasgow. Lectures will be given on hardware available, APL implementations and APL techniques, applications software. A variety of systems will be on view. Fee: £25. Contact: A.P. Ltd, Freepost, Chester CH3 5YZ. Tel: 0244 46024.

●1-3 **Microprocessor workshops.** Venue: London. Designed for engineers with little or no knowledge of microprocessors. The course is based on the AIM-65 board and introduces all aspects of software development by practical programming sessions. Fee: £195 + VAT. Contact: Microsystems Consultants Limited, PO Box 65, Camberley, Surrey GU15 1QN. Tel: 0276 27417.

●3-5 **Pascal language programming.** Venue: Bedford. Designed for system designers, project engineers and programmers who need to learn Pascal. Fee: £250 + VAT. Contact: Mike Hughes, Microprocessor Training Centre, Texas Instruments Ltd, Manton Lane, Bedford MK1 7PA. Tel: 0234 67466 Extn. 3718.

●3, 10, 17, 24 **All-day Basic course.** Venue: Maidenhead. Designed for professionals with some previous knowledge of Basic programming. Using Pets, with emphasis on hands-on training. Fee: £30 per day + VAT. Contact: The Principal, The Academy of Computer Programming, 28 St Mark's Road, Maidenhead, Berkshire. Tel: 0628 24729.

●5 **Computers in agriculture.** Venue: Salford University. For farmers who are thinking of re-organising their farm offices to include a minicomputer or computer terminal. Fee: £6. Contact: G R Wilson, Ministry of Agriculture, Fisheries and Food, York House, Clarendon Avenue, Leamington Spa, Warwickshire, CU32 3PP. Tel: 0926 37221.

●10 **Management and micros.** Venue: Maidenhead. Designed to give to management of small companies the necessary knowledge to enable them to program and control their own applications. Fee: £36 + VAT. Contact: The Principal, The Academy of Computer Programming, 28 St Mark's Road, Maidenhead, Berkshire. Tel: 0628 24729.

●15-16 **6502 course.** Venue: London. A two-day course in conjunction with Commodore introducing the 6502 microprocessor to practising engineers. A basic knowledge of microprocessors is assumed. Fee: £75. Contact: Robin Bradbeer, The Polytechnic of North London, Dept. of Electronic and Communication Engineering, Holloway, London N7 8DB. Tel: 01-607 2789.

●15-26 **Cobol programming.** Venue: London. Teaches the ANSI Cobol programming language. Designed for entry-level programming staff with no previous programming experience who will be writing applications programs in a Cobol environment. Fee: £615. Contact: The Registrar, Infotech, Nicholson House, Maidenhead, Berkshire, SL6 1LD. Tel: 0628 39101.

●16-18 **PACE — Peripherals at the Centre Exhibition.** Venue: Cunard Hotel, Hammersmith, London, Queen Mary Suite. Fee: Free tickets for peripherals buyers. Contact: Martin Boulton, Pacewise Ltd, 8 Colston Avenue, Bristol BS1 4SN. Tel: 0272 276984.

●16-18 **Microcomputers course.** Venue: Leamington Spa. The aims of the course are to demonstrate the capabilities of microcomputers, to give the opportunity to course delegates to test them and to give sufficient training in Basic to enable delegates to write programs. Fee: £149.50. Contact: Coventry Management Training Centre, Woodland Grange, Leamington Spa, CV32 6RN. Tel: 0926 36621.

●17 **Microprocessors in industry.** Venue: Brighton. Designed to give an appreciation of the use of microprocessors in industry and to access their future development in this field. Designed for management and technical staff actually or potentially involved in planning or operating computers in industry. Fee: £70 + VAT. Contact: Carole Jones, MSS Computer & Business Consultancy Ltd, MSS House, 54 Chapel Road, Worthing, West Sussex. Tel: 0903 34755/6.

●17-18 **Programmable calculator course.** Venue: London. A course designed to help new users of programmable calculators to solve practical commercial problems; based on methods used in applications in Unilever companies. Fee: £330 + VAT. Contact: Course Secretary, Management Information Section UIMC Ltd, St Bridget's House, Bridewell Place, London EC4.

●17-19 **Microprocessor Pascal run-time support.** Venue: Bedford. This follow-up course is designed for systems designers, project engineers and programmers who can write single-process Pascal programs. Fee: £250 + VAT. Contact: Mike Hughes, Microprocessor Training Centre, Texas Instruments Ltd, Bedford MK1 7PA. Tel: 0234 67466 Extn. 3718.

●18 **Microprocessors and the small business.** Venue: Brighton. Gives an appreciation of the potential of the microprocessor as a management tool within a small business and to assist in taking a decision as to possible installation. Fee: £70 + VAT. Contact: Carole Jones, MSS Computer & Business Consultancy Ltd, MSS House, 49 Chapel Road, Worthing, West Sussex BN11 1EG. Tel: 0903 34755/6.

●18-19 **Desk-top computers.** Venue: London. A two-day seminar designed to dispel the mystery surrounding computers and through practical use of the Commodore Pet computers, to demonstrate the system's capabilities. Fee: £180 + VAT. Contact: The Organiser, UIMC Limited, St Bridget's House, Bridewell Place, London EC4 4BP. Tel: 01-822 5363.

●22 **Microcomputers in management science.** Venue: University of Sussex. This seminar gives a review of current practice and micro applications in this specialist field. Fee: £60 + VAT. Contact: Dr J W Bryant, The University of Sussex, Operational Research, Mantell Building, Falmer, Brighton BN1 9RF. Tel: 0273 686755.

●22-24 **Second steps in microprocessors.** Venue: Portsmouth Polytechnic. Follow-up course to 'First steps', or for those with a basic knowledge of microprocessors. Fee: £99. Contact: Mrs A P Sizer, Department of Electrical and Electronic Engineering, Portsmouth Polytechnic, Anglesea Road, Portsmouth, PO1 3DJ. Tel: (0705) 27681 Extn. 30.

●23 **Business applications of microcomputers.** Venue: The University of Sussex. This seminar gives a review of mainly financial applications including business packages with manufacturers demonstrations. Fee: £60 + VAT. Contact: Dr J W Bryant, The University of Sussex, Operational Research, Mantell Building, Falmer, Brighton BN1 9RF. Tel: 0273 686755.

●23-26 **London Business Show.** Venue: Cunard International Hotel. Contact: Keith Conroy Associates, 19 Cuckoo Hill Drive, Pinner, Middlesex HA5 3PG. Tel: 01-886 1807.

●30 **Practical introduction to microprocessors.** Venue: Cambridge. Covers the basics of microprocessors and how to use them with hands-on training using the SGS-Ates Nanocomputer. Fee: £50 + VAT. If you buy a Nanocomputer, the course is free. Contact: Cambridge Microcomputers Ltd, Cambridge Science Park, Milton Road, Cambridge, CB4 4BN. Tel: 0223 314666.

BUYERS' GUIDE

Printers and VDUs

The Peripherals Buyers' Guide starts this month with a survey of printers and VDUs suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers and VDUs are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

PRINTERS

ADDMASTER

420/426 receive only — *£246*
Impact column printer, grade-one Tally roll paper at £5 for 20 rolls. BCD serial or 10-line serial interfaces, 12 cpl, 36 cps. Main U.K. agent Clary Ltd.

400 receive only — *£242*
Impact column printer, uses 2½in. Tally roll paper at £5 per 20 rolls, parallel and serial interfaces. 16 cpl, 48 cps. Main U.K. agent Clary Ltd.

ANADEX

DP-500 — *from £367*
Impact drum printer, uses plain paper, parallel interface, 18 cpl, 45 cps. Main U.K. agent Anadex Ltd, OEM sales, U.K. and Europe.

DP-660 — *from £700*
Impact drum printer for printing labels, uses sprocket feed. Parallel interface. 19 cpl, 57 cps. Main U.K. agent Anadex Ltd, OEM sales, U.K. and Europe.

DP-750A — *from £800*
Impact drum printer, RS232C 20mA current loop interface, 21 cps, 25 cps. Main U.K. agent Anadex Ltd, OEM sales, U.K. and Europe.

FP-600 — *from £65*
Impact drum printer with ticket or form printer, from four columns to 19 columns parallel interface, 19 cpl, 44 cps. Main U.K. agent Anadex Ltd, OEM sales U.K. and Europe.

DP-9500 Series — *£895 upwards*
Alpha-numeric line printers with nine-wire print head, adjustable tractor feed with bi-directional printing, three ASCII interfaces as standard — parallel bit, RS232C, current loop — 120-200 cps, 132-220 columns, 7×9, 9×9 or 11×9 matrices depending on model. Main U.K. agents Anadex Ltd, OEM sales U.K. and Europe, Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

DP-8000 — *£550*
Alpha-numeric line printer with sprocket feed and bi-directional printing, fan-fold paper up to 9.5 in., produces up to three copies, cost of paper £14 for box of 2000 sheets. Three ASCII interfaces as

standard — parallel bit, RS232C, current loop — 112 cps, 80 column, 9×7 matrix. Main U.K. agents Anadex Ltd, OEM sales U.K. and Europe, Peripheral Hardware, Kode Services, Robox, Stack, Computer Services and Data Design Techniques Ltd.

DP-1000 Series *from £395*
Dot matrix, impact digital printers, includes internal data storage facilities. Friction feed, uses roll-type paper for 40 columns at £11 for box of 10 rolls, three basic ASCII-compatible interfaces are available. 40 cpl, 50 cps, 40 columns, 5×7 matrix. Main U.K. agents Anadex Ltd, OEM sales U.K. and Europe, Peripheral Hardware, Kode Services, Robox, Stack Computer Services.

AXION CORPORATION

EX-820 receive only *£500*
High-speed electro-sensitive dot matrix includes plotting capability for full graphics, at £3 for a 240ft. roll, RS232C or 20mA serial and ASCII parallel input as standard, 20/40/80 cpl and up to 160 cps, 5×8 matrix. Main U.K. agent Memec Systems Ltd.

EX-850 Video Printer *£500*
High-speed electro-sensitive dot matrix, uses aluminised paper at £3 for a 240ft. roll. By using a video controller, the EX-850 dispenses with the need for any interfacing between the user's CRT display/terminal and printer — needs only the video signal. Normal resolution 13.5 seconds per screen, high resolution 27 seconds per screen. Main U.K. agent Memec Systems Ltd.

EX801/802 receive only *£279*
Electro-sensitive, dot matrix, uses aluminised paper at £3 for a 240ft. roll, RS232C, Centronics, Apple, Pet, and Tandy interfaces, 20/40/80 cpl, 160 cps, 5×8 matrix. Main U.K. agent Memec Systems Ltd.

BASE 2

800-MST *from £385*
Impact dot matrix, bi-directional, uses plain paper up to 9½in., RS232C, 20mA, IEEE-488, Centronics and parallel interfaces, up to 132 cpl and 60 cps, with 5×7 matrix. Main U.K. agents Microbyte and Maclin-Zand Electronics Ltd.

CENTRONICS

Model 700 *P.O.A.*
Impact, dot matrix, uses fan-fold paper, parallel, serial, RS232C interfaces, 132 cpl, 60 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wirless, Dacoll Engineering.

Model 701 *P.O.A.*
Impact, dot matrix, uses fan-fold paper, parallel, serial, RS232C interfaces, 132 cpl, 60 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 702 *P.O.A.*
Impact, dot matrix, uses fan-fold paper, parallel, serial, RS232C interfaces, 132 cpl, 120 cpls, 7×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 703 *P.O.A.*
Impact, dot matrix, uses fan-fold paper, parallel, serial, RS232C interfaces, 132 cpl, 180 cps. 7×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 781 *P.O.A.*
Impact, dot matrix, pinch-roll paper feed for roll paper with fan-fold, tractor-feed option, standard parallel interface with serial RS232C option, 80 cpl, 60 cps, 5×7 matrix. Main U.K. agents, Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 753 *P.O.A.*
Impact, dot matrix, uses fan-fold paper, standard parallel interface with serial RS232C option, 132 cpl, mono-spaced, 100 cps mono-

spaced, 130-150 cps proportional n×9 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 791 — *P.O.A.*
Demand-document printer, impact, dot matrix, uses multi-part forms, up to 12-part using bottom feed tractors, standard parallel interface, with serial RS232C interface option, 80 cpl, 60 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT electronic services, Cable and Wireless, Dacoll Engineering.

Model 730 — *P.O.A.*
Impact, dot matrix, uses roll paper up to 8.5 in. wide, fan-fold paper up to 9.5 in. wide and cut sheet up to three-ply paper and two carbons, parallel-standard interface with serial RS232 option, 80 cpl, 100 cpls, 7×7 matrix. Main U.K. agents, Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering, Datac Ltd, Rair Ltd, Comma Computers and MIBF.

Model 737 — *P.O.A.*
Impact dot matrix, roll fan-fold or cut sheet paper, standard parallel interface, serial RS232C option, 80 cpl mono-spaced mode, 50 cps mono-spaced mode, 80 cps proportional mode, 7×8 matrix mono-spaced, n×9 proportional. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering, Datac Ltd.

Model P1 Microprinter and Model S1 Microprinter — *P.O.A.*
Non-impact dot matrix electro-sensitive uses aluminium-coated paper roll, P1 — parallel interface, S1 — serial RS232C interface, up to 80 cpl, and 150 lines per minute, up to 200 cps. Main U.K. agent, Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering, Datac Ltd.

Model 780 — *P.O.A.*
Impact, dot Matrix, pinch-roll paper feed for roll paper, tractor-feed option for rear- and bottom-feed forms and fan-fold paper, standard parallel interface with serial RS232C option, 80 cpl, 60 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 779 — *P.O.A.*
Impact, dot matrix, pinch-roll paper feed for roll paper, with fan-fold, tractor feed option, standard parallel interface with RS232C serial option, 80-132 cpl, 60-110 cps, 5×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 704 — *P.O.A.*
Impact, dot matrix, uses fan-fold paper, RS232 serial interface, 132 cpl, 180 cps using 7×7 matrix, choice of 7×7, 9×7 and 9×9 matrices. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 761 read only or keyboard send/receive — *P.O.A.*
Impact, dot matrix, uses fan-fold paper, RS232C/CCITT V24 or DC current loop interfaces, 132 cpl, 60 cps, 7×7 matrix. Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

COMMODORE

CBM 3022 — *£425*
Tractor-feed printer, uses fan-fold paper with three-in. to 12in. width, cost of paper £10 per 1,000, IEEE interface, 80 cpl, 150 cps, 6×7 matrix. Main U.K. agent Davinci Computers Ltd.

DATAC

414 free-standing assembly receive only — *£130*
Electro-sensitive, matrix printer type 245L, electro-sensitive roll paper, 59mm. wide × 30m. long at 90p per roll for 20 off, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 character per serial, 7×5 matrix. Main U.K. agent Datac Ltd.

DMI-40P free-standing terminal, receive only — *£350*
Impact, matrix, uses pressure-sensitive roll paper, 108mm.-wide ordinary paper version, using ink ribbon. Cost of paper £1 per roll, seven-bit parallel ASCII, character serial, buffered asynchronous or EIA/RS232C or graphics mode, direct control of needles interfaces,

40 or 20 cpl under software control, up to 80 cps, 7×5 matrix. Main U.K. agent Datac Ltd.

411C compact panel mounting, receive only — *£209*
Electro-sensitive matrix type 245 L or R, uses electro-sensitive roll paper, 59mm. wide × 30m. long at 90p per roll, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 cps, 7×5 matrix. Main U.K. agent Datac Ltd.

411 panel mounting, receive only — *£189*
Electro-sensitive matrix printer type 245 L or R, uses electro-sensitive roll paper, 59mm. wide × 30m. long at 90p per roll. Interfaces include six-bit parallel ASCII, character serial, four-bit parallel BCD, character parallel EIA/RS232C, CCITT/V24 and 20mA current loop, under development 40 cpl, 32 to 80 cps, 7×5 matrix. Main U.K. agent Datac Ltd.

313 panel-mounting, receive only and 312 free-standing, receive only — *£269*
Impact matrix type PU-1100, Tally roll paper, 59mm. wide × 36m. long at 60p per roll, CCITT/V24 or EIA RS232C or 20mA current loop interfaces, up to 20 cpl and up to 36 cps, 7×5 matrix. Main U.K. agent Datac Ltd.

412/1 and 412/5 receive only — *£255*
Electro-sensitive dot matrix type 245L, uses electro-sensitive aluminium-coated paper, 59mm. × 30m. at 90p per roll, six-bit parallel, ASCII, character serial and four-bit parallel BCD, character parallel, RS232C/V24 interfaces, 20mA current loop (/4) under development, 16, 20, 32 or 40 cpl, 32-80 cps, 7×5 matrix. Main U.K. agent Datac Ltd.

522/1 and 522/4 receive only — *£499 (522/1) £535 (522/4)*
Impact matrix type 115DR, uses ordinary roll paper, 114mm. × 75m. up to three copies plus original, cost of paper £1.10 per roll. Parallel interface (552/1) and RS232C, 20mA current loop and parallel buffered, asynchronous interfaces — (522/4). 40 cpl, 100 cps instantaneous rate, 33 cps average rate — including CR and LF. 7×5, 4×5, 7×10, 14×10 — 4 version only, under software control. Main U.K. agent Datac Ltd.

DATA DYNAMICS

303 printer — *£980*
Dot matrix, high-definition printer, uses up to six-part stationery width from 3in. to 15.375 in., CCITT V24 (EIA RS232C) 20mA current loop, 132 cpl, 30 or 60 cps, 7×7 matrix. Main U.K. agent Data Dynamics.

ZIP ASR/K7 twin cassette — *£2,000*
Seven-needle head prints the full ASCII character set in dot matrix format, uses standard Telytype roll paper, V24, RS232C, or 20mA current loop operating at half or full duplex, 80 cpl, 10 or 30 cps switch selected, 5×7 matrix. Main U.K. agent Data Dynamics.

ZIP 30 keyboard printer, RO, ASR, or KSR — *ASR £1,800 RO & KSR £950*
Dot matrix printer, uses standard roll paper, 20mA half or full duplex current loop or V24 CCITT, RS232C, interfaces, 80 cpl, 10 or 30 cps — switch selected, 5×7 matrix. Main U.K. agent Data Dynamics.

390 eight-level and 392 five-level — *ASR from £1,250 KSR from £900 RO from £800*
Available in ASR, KSR and read-only versions. Impact printers, use friction or sprocket feed uses 8½in. paper with maximum roll diameter of 5in. 74 or 86, 6.6 or 10 cps. Main U.K. agent Data Dynamics.

Models 32 and 33 page printers — *ASR from £1,100 KSR from £800 RO from £700*
Available in ASR, KSR and receive-only versions. Friction or sprocket feed, 20mA or 60mA parallel input and output interfaces, up to 86 cpl, 6.6 or 10 cps. Main U.K. agent Data Dynamics.

DATA GENERAL CORPORATION

Dasher TPI Printer models 6040 and 6041 — *from £1,598*
6040 uses a standard typewriter keyboard and has an off-line mode which enables it to be used as a typewriter, the 6041 is a receive-only terminal printer without a keyboard, 30 or 60 cps, switch selectable, EIA-RS232C interfaces. 5×7 dot matrix. Main U.K. agent Data General.

DATAPLUS

400 series receive-only Model 480 — *£475*
Impact dot matrix, uses standard Tally roll, up to 3.75 in. wide, from 80p per roll, RS232C, V24, 20mA current loop, bit parallel IEEE, Pet and Apple interfaces, 30/40 cpl, 110 cps, 7×5 and 7×10 matrices. Main U.K. agent Dataplus Ltd.

DATASOUTH CORPORATION

DS-180 — *£1,360*
Impact, matrix printer, uses fan-fold paper, RS232C, Current loop, and parallel interfaces, 132 cpl, 180 cps, 9×7 matrix. Main U.K. agent Sigma U.K.

DIABLO

HY type II receive only — *P.O.A.*
Impact daisywheel plastic or metal print wheel, parallel, interface, 132 10-pitch cpl or 158 12-pitch cpl, 40/45/55 cps. Main U.K. agent Diablo Systems Ltd.

1650 receive only and keyboard send/receive — *RO £2,200* *KSR £2,525*
Daisywheel impact printer using metal printwheels, uses standard listing or single-sheet paper, RS232C CCITT V24, parallel and current-loop option interfaces, 132 cpl at 10 pitch, 158 cpl at 12 pitch, up to 38 cps, line speeds to 9,600 bauds. Main U.K. agents Geveke Electronics Ltd, Rair Ltd.

1640 receive only or keyboard send/receive — *RO £2,100* *KSR £2,400*
Daisywheel, impact printer using plastic printwheels, uses standard listing or single-sheet paper, RS232C CCITT V24, parallel and Current loop interfaces, 132 cpl at 10 pitch, 158 cpl at 12 pitch, up to 40 cps, line speeds to 9,600 bauds. Main U.K. agents Geveke Electronics Ltd, Rair Ltd.

630 receive only — *£1,725*
Daisywheel, impact printer with interchangeable metal /plastic printwheels, uses standard listing or single sheet paper, RS232C, CCITT V24 with optional bus interface, 132 cpl at 10 pitch, 158 cpl at 12 pitch, 198 cpl at 15 pitch, up to 40 cps with automatic bi-directional printing. Main U.K. agent Geveke Electronics.

DIGITAL EQUIPMENT

DecWriter LA34 KSR — *£824*
Dot matrix, uses roll or fan-fold paper, friction feed, up to five copies, V24 or 20mA interfaces, adjustable up to 256 cpl, 30 cps, 7×9 matrix. Main U.K. agent Extel.

LA-120 DecWriter III — *£1,650*
Seven-needle head mechanism, uses standard paper, single or multi-part, RS232C or 20mA interfaces, 132/218 cpl, 180 cps, 7×9 matrix. Main U.K. agent Data Design Techniques Ltd.

LA36 DecWriter II — *from £995*
Seven-needle head, uses standard paper, single or multi-part, RS232C or 20mA interfaces, 132/218 cpl, 30/120 cps, 7×9 matrix. Main U.K. agent Data Design Techniques Ltd.

LA32 DecWriter IV — *£725*
Seven-needle head mechanism, uses standard paper, single or multi-part, RS232C or 20mA interface, 132/218 cpl, 30 cps, 7×9 matrix. Main U.K. agent Data Design Techniques Ltd.

VT-100 — *£1,150*
Intelligent VDU with separate keyboard including numeric pad, 80/132 characters wide × 12 or 24 characters high, underline or block cursor, in 103 mode consists of 32K word 16-bit computer system, RS232C or 20mA interfaces. Main U.K. agent Data Design Techniques Ltd.

ELECTROGRAPHIC AV

EG-800 receive only — *from £450*
Impact, matrix printer, uses any type of paper, parallel, RS232C,

TRS-80, Apple interfaces, 80 cpl, 150 cps, 7×5 or 7×6 matrix. Main U.K. agent Electrographic AV Ltd.

500 series receive only — *from £175 for mechanism only*

Impact, matrix printer, uses 3½in. Tally roll paper and flat documents, serial or parallel interfaces, 40 cpl, 120 cps, 7×5 or 7×6 matrices. Main U.K. agent Electrographic AV Ltd.

EPSON

TX-80 — *£395*

Impact, dot matrix, friction-feed version uses Telex rolls, tractor feed version uses computer-type listing paper, cost from £1 per roll, RS232C, V24, 20mA current loop, bit parallel, Centronics, IEEE, Pet, Apple and TRS-80 interfaces, 80 CPL, 150 cps, 7×5 or 7×10 matrices and graphics. Main U.K. agent Dataplus Ltd.

EXTEL CORPORATION

M30 receive only, keyboard send/receive and automatic send/receive — *£895*

Impact, dot matrix printer, uses roll or fan-fold paper, V24 or 20mA interfaces, 80 cpl, 30 cps (50 with buffer) 5×7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

M30 B208L keyboard send/receive — *£1,270*

Dot matrix, uses roll paper, V24 or 20mA interfaces, 80 cpl, 30 cps, 5×7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

FACIT

4520 and 4521 — *£583*

Seven-wire print head, uses roll paper Telex type (Facit 4520), friction feed, fan-fold (Facit 4521) pin feed, serial, V24/RS323C, Centronics parallel interfaces, both fitted as standard, 80 cpl, 100 cps at 12 characters per inch, 9×7 matrix. Main U.K. agent Facit Ltd.

GENERAL ELECTRIC, U.S.A.

ITT 3330 — *£1,496*

Impact dot matrix, uses plain paper, sprocket feed, V24 interface, 132 cpl, 10, 20 or 30 cps, 7×9 matrix. Main U.K. distributor ITT Business Systems U.K.

HEATH ELECTRONICS

WH14 — *£510*

Dot matrix, uses edge-punched fan-fold paper, at £24, 20mA, RS232C Interfaces, 80, 96, 132 cpl, 132 cpls, 5×7 matrix. Main U.K. agent Heath Electronics U.K. Ltd (OEM sales).

LEAR SIEGLER INC

300 series — *from £965*

Ballistic-matrix, uses standard paper, RS232C, 20mA parallel interfaces Centronics 701/703 type 132 cpl, 180 cps, 9×7 or 9×9 matrices. Main U.K. agent Penny & Giles Data Recorders Ltd.

LOGABAX

LX-213 — *£1,590*

Nine-wire matrix printer, uses plain paper, fan-fold or cut up to six-ply, RS232C or V24 interfaces, 132 cpl at 10 pitch, 218 cpl at 16.5 pitch, 180 cps, 9×7 matrix, optimised bi-directional printing. Main U.K. agent Brospa Data Ltd.

LRC EATON

7000+ — *£250*

Impact, matrix printer, uses roll paper, RS232, IEEE, current loop and parallel interfaces, 20 and 40 cpl selectable by software, 20, 32, 40 and 64 cpl software selectable by option, 40 cps, 7×7 matrix. Main U.K. agent Sigma U.K.

MALIBU ELECTRONICS CORP.

165 — *£1,400*
Impact matrix, dot-addressable by software, uses fan-fold paper, RS232C, current loop and parallel interfaces, 132 cpl, 165 cps, 10×9 matrix. Main U.K. agent Sigma U.K.

MANNESMAN TALLY

M-80 MC — *from £875*
7/9 needle head mechanism, uses 9½in. standard listing paper, all interfaces, 80/132 cpl, 200 cps, 7×9 or 9×9 matrices. Main U.K. agent Data Design Techniques Ltd.

MICRO PERIPHERALS INC

MPI-88T — *£535*
Impact, matrix printer, uses fan-fold, roll and cut-sheet paper, RS232C, Current loop and parallel interfaces, 80/96/120/132 cpl, all software-selectable, 120 cps, 7×7 matrix. Main U.K. agent Sigma U.K.

NEC

Spinwriter — *£2,195*
High-quality printer, uses ordinary paper, RS232C, Centronics, Diablo, Qume, Serial and parallel interfaces, up to 163 cpl, 55 cps, solid-font matrix. Main U.K. agent Memec Systems Ltd.

NEWBURY LABORATORIES

Model 8300 — *from £475*
Dot matrix, impact printer, uses pin-feed method for paper up to 9.5 in., £16.50 per box, eight-bit parallel interface or CCITT V24, RS232C interfaces, 10 characters per inch, 125 cps, 7×9 matrix. Main U.K. agent Newbear Computing Store.

NIPPON ELECTRIC COMPANY

Spinwriter — *£1,500*
Combines golf-ball daisywheel and thimble mechanism, uses continuous or single-sheet computer paper, RS232C serial (RO and KSR), Centronics-compatible and Diablo-compatible interfaces, 8080 input bus line, curent loop and custom microprocessor-controlled interfaces, 55 cps, solid-font matrix. Main U.K. agent Memec Systems Ltd.

QUME

Sprint 5/45 receive only — *£1,795*
Daisywheel mechanism, uses plain paper, fan-fold or cut appear A4 up to six-ply, RS232C or V24 iinterfaces, 156 cpl at 12 pitch, 45 cps. Main U.K. agent Brospa Data Ltd.

RAIR

820/825 Desk-top printer — *£1,090*
Dot matrix, RS232C interface, 132 cpl, 75 or 150 cps, 7×7 matrix. Main U.K. agent Rair.

DecWriter IV keyboard printer, KSR and read only — *£795*
Dot matrix, uses standard listing paper, RS232C current loop interface, 215 cpl, 30 or 180 cps, 9×7 matrix. Main U.K. agent Rair.

M200 — *£1,995*
Dot matrix, uses continuous paper, parallel or serial interface. 132 cpl, 340 cps, double 7×9 matrix. Main U.K. agent Rair.

Hyterm 1640 and 1650 — *1640 without keyboard*
Metal or plastic daisywheels, uses cut-sheet or continuous paper,

serial or current loop interfaces, 215 plus cpl, up to 45 cps. Main U.K. agent Rair. — *£2,100, with keyboard £2,350. 1650 without keyboard £2,200, with keyboard £2,450.*

DecWriter III — *£1,550*
Dot Matrix, uses continuous listing paper, RS232C or 20mA, current loop interfaces, 132-215 cpl, 180 cps, 7×7 matrix. Main U.K. agent Rair Ltd.

RICOH

RP-1600 — *£1,295*
Daisywheel mechanism, typeface, uses single-sheet or continuous paper, from £6 per 1,000 sheets, Centronics and compatible interfaces, 132 cpl, 60 cps. Main U.K. agent Camden Electronics.

S FARID (SPECTRONICS) MANUFACTURING

TP-40 and TP-64 receive only — *from £660*
Thermal, matrix, uses thermal paper, cost of paper £1.80 each roll, seven-bit parallel interface, push-button control and self-test, 40 or 64 cpl, 13 or 18 cps, 7×5 dot matrix. Main U.K. agent S Farid (Spectronics) Manufacturing Ltd.

SIGMA INTERNATIONAL INC

Sintelwriter — *£2,064*
NEC 5500 range of thimbles, uses fan-fold paper, cut-sheet paper optional, RS232C and parallel interfaces, 136 or 163 cpl, up to 55 cps. Main U.K. agent Sigma U.K.

TALLY

T1612 keyboard send/receive — *£1,612*
Seven/nine needle-head mechanism, uses standard, single- or multi-part paper, RS232C or 20mA interfaces, 132/218 cpl, 160 cps, 7×9 or 9×9 matrices. Main U.K. agent Data Design Techniques Ltd.

T1612 receive only — *£1,475*

T1602 — *£1,395*
Seven/needle-head mechanism, uses standard, single- or multi-part paper, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7×9 matrix. Main U.K. agent Data Design Techniques Ltd.

T2000 — *from £2,000*
Comb print mechanism, uses standard, single- or multi-part paper, all interfaces, 132 cpl, 200 lines per minutes, 7×7 or 9×9 matrices. Main U.K. agent Data Design Techniques Ltd.

TELETYPE CORPORATION

Model 43 keyboard send/receive — *£800*
Impact matrix printer, uses pin-feed or friction-feed, dual RS232C and 20mA Current loop interfaces, 132 cpl, 30 cps sustained 300 bauds, 4×7 matrix on 9-wire printhead. Main U.K. agent Geveke Electronics Ltd.

TEXAS INSTRUMENTS

OMNI 800 series
Models 810, 820 and 825 — *from £1,090 to £1,650*
Available in keyboard send/receive and receive-only impact, matrix printers, uses plain paper, EIA, current loop, parallel interfaces, 132-216 cpl compressed print (models 820 and 825), 132 cpl (model 810), 75 cps (models 825), 150 cps (models 810 and 820), 9×7 matrix. Main U.K. agents Texas Instruments Ltd, and Rair Ltd.

Silent 700 model and 765 bubble-memory terminal — *£2,395*
Thermal mechanism, uses thermal paper at £1.50 for a 100ft. roll,

Integral acoustic coupler, EIA interfaces, 80 cpl, 30 cps, 5×7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

Silent 700 model and 763 bubble-memory terminal *£2,195*
Thermal mechanism, uses thermal paper at £1.50 per 100 ft. roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5×7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

Silent 700 model and 745 portable *£1,250*
Thermal mechanism, uses thermal paper at £1.50 per 100 ft. roll, integral acoustic coupler, EIA interface, 80 cpl, 30 cps, 5×7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

Silent 700, 743 Keyboard send/receive version *£1,105*
Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5×7 matrix. Main U.K. agent Texas Instruments Ltd, and Rair Ltd.

TRANSDATA

313 Receive only *£790*
Thermal, matrix mechanism, uses thermal paper at £60 per box of 24 rolls × 150 ft. RS232C and parallel interfaces designed for use as VDU hard copy, 80/132 cpl, 30 to 45 cps, 7×5 matrix. Main U.K. agent Transdata Ltd.

TRANSTEL COMMUNICATIONS

AHR receive only *P.O.A.*
Impact, matrix, uses standard teleprinter paper, V24, current loop interface, 80 cpl, 30 cps, 7×5 matrix. Main U.K. agent Transtel Communications Ltd.

TREND COMMUNICATIONS

800 receive only *P.O.A.*
Impact, matrix, uses standard Telex roll paper, current loop, RS232C 80-0-80 interfaces, 80-132 cpl, 30 cps, 7×5 matrix. Main U.K. agent Trend Communications Ltd.

UNITED SYSTEMS CORPORATION

DigiTec 6320 *£483*
Electro-sensitive dot matrix, includes moving stylus, first line down, input line buffer, uses electro-sensitive line roll paper at £1.80 per roll, RS232C or isolated 20mA curent loop selectable and handshake TTL-compatible interfaces; asynchronous/synchronous, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6330 *£421*
Electro-sensitive dot matrix, includes moving stylus — first line down, input line buffer, uses electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial and handshake, TTL compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6410 *£237*
Electro-sensitive dot matrix, includes moving stylus, first line up, input line buffer, uses electro-sensitive paper at £1.80 per roll, RS232C or 20mA current loop switch-selectable TTL-compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6420 *£237*
Electro-sensitive dot matrix, moving stylus, first line up, input line buffer, uses electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial and handshake TTL-compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, prints two lines per second, 1200 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6450 *£266*
Thermal, dot matrix, moving stylus, first line up, input line buffer, uses thermal paper at £1.80 per roll, RS232C or isolated 20mA current loop, switch-selectable TTL-compatible, asynchronous/synchronous interfaces, 21 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6460 *£266*
Thermal, dot matrix, moving stylus, first line down, input buffer line, uses thermal paper at £1.80 per roll, eight-bit parallel/character serial handshake, TTL-compatible, asynchronous/synchronous interfaces, 21 cpl, prints two lines per second, up to 1,000 baud receive. 5×7 matrix. Main U.K. agent Aviquipo Ltd.

DigiTec 6550 *£289*
Thermal, dot matrix, moving stylus, first line down, input buffer line, uses thermal paper at £1.80 per roll, RS232C or 20mA current loop, switch-selectable, TTL-compatible, asynchronous/synchronous interfaces, 21 or 32 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix. Main U.K. agent Aviquipo Ltd.

VECTOR GRAPHIC

MP printer *£599*
Uni-directional seven-wire × five-column dot matrix, original and one copy, maximum paper thickness 0.2mm., uses pin-wheel paper feed, 70 lines per minute, 150 cps, TTL level interface, two parallel output ports and one-parallel input port. Main U.K. agent Almarc Data Systems Ltd.

WALTERS MICROSYSTEMS

BD-80P *£475*
Process-controlled, full graphics set, user-definable graphics, fan-fold tractor feed, cost of paper £6 per 1,000 sheets, IEEE, RS232C and parallel interfaces, 80 or 132 cpl, 130 cps, 9×7 matrix. Main U.K. agent Camden Electronics.

WENGER DATENTECHNIK

Penny & Giles matrix printer *from £700*
Uses standard paper, RS232C, 20mA, 60mA and parallel interfaces, Centronics-compatible, 80 cpl, constant throughput 80 cps, 55-1000 lines per minute, 7×7 matrix. Main U.K. agent Penny & Giles Data Recorders Ltd.

Penny & Giles hard copier *from £365*
Electro-static mechanism, uses RMP paper 127mm. × 70m. at £3.50 per roll, RS232C, parallel interface and current loop option, 80/40/20 cpl, user-programmable, 80 columns message, 110 lines per minute, 5×8 line printer, 5×7 message printer matrix. Main U.K. agent Penny & Giles Data Recorders Ltd.

WHYMARK INSTRUMENTS

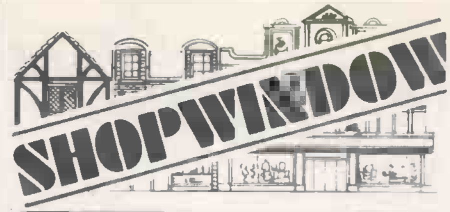
Model 201 *£440*
Dot matrix, Tally-roll plain-paper printer, IEEE, RS232C, serial, and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes. Main U.K. agents Whymark Instruments Ltd.

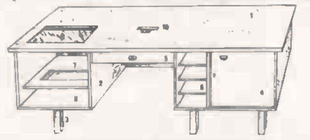
Model 204 label printer *£515*
Dot matrix, impact printer for self-adhesive labels, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes. Main U.K. agent Whymark Instruments Ltd.

Model 301 ticket/form printer *£690*
Dot matrix impact printer for plain paper, options automatic date and time, pre-programmed text, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four character sizes. Main U.K. agent Whymark Instruments Ltd.

Model 501 rack-mounting printer *£625*
Dot matrix impact printer for plain paper, options automatic date and time, pre-programmed text, IEEE, RS232C, serial and parallel interfaces, 40 cps, 40 cpl, 52 character set with four character sizes. Main U.K. agent Whymark Instruments Ltd.

Model 801 80/120 column printer *£750*
Dot matrix, impact printer for plain or fan-fold paper, proportional spacing up to 120 cpl, 120 cps, bi-directional printing, user-definable character set, up to 4K selectable character fonts, graphics, and user-defined characters, also available; very large characters seven lines high. Main U.K. agent Whymark Instruments Ltd.





VDUs

APPLIED DIGITAL DATA SYSTEMS

Regent 60 — *£599 — £899*
Integral, separate and numeric pad keyboard, 12-in. screen, 80 characters wide, switch-selectable cursor, buffered, protected fields, can transmit page line or modified data only, special character sets U.K., U.S., German, Swedish, Finnish, Danish, Norwegian, Spanish, French (Azerty), Arabic, V24, current loop, auxiliary interfaces. Main U.K. agent Terminal Display Systems Ltd.

CIFER SYSTEMS

2604 — *£680*
Non-intelligent VDU, separate keyboard, no numeric pad, 12in. screen, 24 × 80 characters, blinking, underscore cursor, user-defined alternate character set available, V24 with optional current loop interface. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

2684 — *£1,995*
Intelligent VDU, with separate numeric pad, 12in. screen, 24 × 80 characters, blinking, underscore, soft-selectable cursor, includes integral floppy-disc unit, two Z-80 processors, 64K memory associated with disc processor, more than 150 commands associated with disc processor, optional character sets, V24 or optional current loop interface. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

2632 — *£890*
Semi-intelligent VDU with separate keyboard and numeric pad, 12in. screen 24 × 80 characters, blinking, underscoring, soft-selectable cursor, more than 150 commands, user definable character sets, V24 interface with current-loop option. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

2653 — *£890*
Non-intelligent VDU with separate keyboard DG6053 emulator, numeric pad, 12in. screen, 24 × 80 characters, blinking and underscoring cursor, user-definable character sets, V24 interface with optional current loop. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

2652 — *£890*
Non-intelligent VDU with separate keyboard and numeric pad and VT52 emulator, 12in. screen 24 × 80 characters, blinking and underscoring cursor, user definable character sets, V24 interface with optional current loop. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

2605 — *£770*
Non-intelligent VDU, with separate keyboard and numeric pad, 12in. screen 24 × 80 characters, blinking and underscoring cursor, user-definable character sets, V24 interface with optional current loop. Main U.K. agent Cifer Systems Ltd, OEM sales U.K. and Europe.

CPU COMPUTERS

Pentland III — *£594*
Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen, 24 × 80 characters, limited cursor control, RS232C and current loop interfaces. Main U.K. agent CPU Computers Ltd.

Pentland VI — *£660*
Semi-intelligent VDU, integral keyboard with numeric pad, 12in. screen with bonded-face plate, 24 × 80, full cursor control, includes extra page of memory, line and page-scroll and row-interchange function, RS232C and current loop interfaces. Main U.K. agent CPU Computers Ltd.

DACOLL ENGINEERING SERVICES

M242 *£600*
Semi-intelligent VDU, with integral keyboard and numeric pad, 12in. screen 25 × 80 characters or optional 25 × 132 characters, underlining cursor, flashing or steady, includes Intel 8085 microprocessor, optional character sets, RS232C and current loop interfaces. Main U.K. agent Dacoll Engineering Services Ltd.

M248 *from £795*
Intelligent VDU with separate keyboard and numeric pad, 12in. screen, 25 × 80 characters or an optional 25 × 132 characters, either underline or inverse video block cursor, blinking or steady, includes Intel 8085 microprocessor, optional character sets, RS232 and current loop interfaces. Main U.K. agent Dacoll Engineering Services Ltd.

M247 *£890*
Intelligent VDU, with separate keyboard and numeric pad, 12in. screen 25 × 80 characters, underlining cursor, blinking or steady with inverse video, includes Intel 8085 microprocessor, optional character sets, RS232C and current loop interfaces. Main U.K. agent Dacoll Engineering Services Ltd.

DATA GENERAL CORPORATION

Dasher D2 display 6053 *£1,728*
Operator-orientated, 96-character, upper- and lower-case alphanumeric display with detached keyboard, direct cursor positioning and sensing, 9 × 6 screen, 24 lines × 80 characters, asynchronous communications interface, RS232C and 20mA, 7×8 dot matrix. Main U.K. agent Data General.

Dasher D3 display 6093 *£1,885*
Operator-orientated, 96-character ASCII, alpha-numeric terminal, detached, sculptured typewriter keyboard with integral 14-key data-entry pad and 18 function keys, industry-compatible asynchronous communications interface, 20mA, EIA RS232C, direct cursor positioning and sensing, 9×6 screen, 24 lines × 80 characters, 5×8 dot matrix. Main U.K. agent Data General.

Dasher D100 and D200 *from £1,141*
Operator-orientated, 96-character ASCII, alpha-numeric terminals, detached, movable, typewriter-style keyboard, industry-compatible asynchronous serial communications interface, 20mA, EIA RS232C current loop, direct cursor positioning and sensing, 9×6 screen, 24 lines × 80 characters, 7×11 dot matrix. Main U.K. agent Data General.

DIGITAL EQUIPMENT

VT-100 *£1,100*
Separate numeric, standard keyboard with 12in. screen, 132 or 80 characters wide, 14 or 24 characters high, full cursor controls with special character sets, RS232C and 20mA interfaces, unintelligent. Main U.K. agent Rair Ltd.

VT103 LSI-11 *£1,971*
CRT monitor, detachable keyboard, alpha-numeric plus separate numeric keypad, up to 132 columns × 24 line display and 7×9 dot matrix, includes operator-selectable double-height/double-width characters, double-intensity, normal and reverse video, blinking, underlining and variable tabulation, parallel and serial, EIA, 20mA, current loop, RS232C, RS423 and RS422 interfaces. Main U.K. agent Rapid Recall.

HAZELTINE

1520 *£1,050*
Intelligent VDU with separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing and printing and special character sets, RS232C and 20mA interfaces. Main U.K. agent Rair Ltd.

1510 — *£880*

Intelligent VDU with separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing and special character sets, RS232C and 20mA interfaces. Main U.K. agent Rair Ltd.

1500 — *£785*

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls and special character sets, RS232C or 20mA interfaces, unintelligent. Main U.K. agent Rair Ltd.

1420 — *£675*

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls, with special character sets, RS232C interface, unintelligent. Main U.K. agent Rair Ltd.

1410 — *£590*

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with special character sets, RS232C interface, unintelligent. Main U.K. agent Rair Ltd.

IBM

3101/20 — *£994*

Intelligent VDU with separate standard numeric keypad 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing, RS232C and 20mA interfaces. Main U.K. agent Rair Ltd.

3101/10 — *£922*

Separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls, RS232C or 20mA interfaces, uinintelligent. Main U.K. agent Rair Ltd.

ITT COURIER, U.S.A.

3280 Visual display system — *P.O.A.*

Separate numeric pad keyboard, 80 characters wide × 24 characters high, cursor control, non-intelligent but has own intelligence for self-checking diagnostics, languages for all countries and 'APL', V24 interface. Main U.K. agent ITT Business Systems.

LYNWOOD SCIENTIFIC DEVELOPMENT

Beta — *£1,311*

Separate keyboard with numeric pad, 30 × 80 characters, underlining cursor, blinking with inverse video, 16K memory expansion, RS232C, V24/20-60mA interfaces. Main U.K. agent Lynwood Scientific Development Ltd.

NEWBURY LABORATORIES

7000 — *£495*

Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen, 24 × 80 characters, block cursor, V24, 20-60mA, current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

700C 5

Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen 24 × 80 characters, block cursor with cursor addressing, V24 or 20mA current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7009 — *£795*

Intelligent VDU, integral or separate keyboard option, with numeric pad, 12in. screen 24 × 80 characters, block cursor, includes full editing facilities, block transmission, highlighting features, cursor addressing and seven pages of memory, also includes special character sets, V24, 20-60mA, and current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7007 £745
Intelligent VDU with integral or separate keyboard options and numeric pad, 12in. screen 24 × 80 characters, block cursor, includes full editing facilities, block transmission, highlighting features and cursor addressing, also includes special character sets, V24, 20-60mA and current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7002C £645
Non-intelligent VDU, integral or separate keyboard options, with numeric pad, 12in. screen, 24 × 80 characters block cursor with cursor addressing, includes hard copy printer output and connection for external monitor, V24 or 20mA current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

7002 £595
Non-intelligent VDU, integral or separate keyboard option, with numeric pad, 12in. screen 24 × 80 characters, block cursor, includes hard copy printer output and connection for external monitor, V24 or 20mA current loop interfaces. Main U.K. agent Newbury Laboratories Ltd.

E1904 £775
Intelligent VDU, integral numeric keyboard, 12in. screen, 80 cpl, 24 lines per screen, cursor controls, full edit features, block transmission by line or page, XY cursor address, protected field format, two-page memory, roll or page mode. Serial interface CCTTT, V24, RS232C and 20/60mA current loop. Main U.K. agent Extel.

E1204 £595
Integral numeric keyboard, 12in. screen, 80 cpl, 24 lines per screen, V24 and 20mA interfaces, unintelligent. Main U.K. agent Extel.

PERICOM DATA SYSTEMS

6801 £985
Semi-intelligent VDU, separate keyboard with numeric pad, 15in. screen, 24 × 80 characters, underlining, blinking cursor, includes special character sets, RS232C, current loop interfaces, fully Post Office approved. Main U.K. agent Pericom Ltd.

6803 £1,285
Semi-intelligent VDU, separate keyboard with numeric pad, 15in. screen, 24 × 80 or 24 × 132 characters, switch-selectable or software-selectable, underlining, blinking cursor, includes special character sets, RS232C, current loop interfaces, fully Post Office approved. Main U.K. agent Pericom Ltd.

SOROC TECHNOLOGY INC

IQ140 £860
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Clary Ltd, 01-680 2222	12-14 Lower Addiscombe Road, Croydon, Surrey CR9 6AG.
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Son of Hexadecimal Kid

A parable in eight virtual pages by Richard Forsyth

Page 0 — the base page

The Hexadecimal Kid, Hex to his friends, is dead, buried beneath a billion tons of rubble, but his line lives on. For though he never knew it, Cleo, the human girl he met at Sprocket's Hole, is carrying his child. This is the story of that child, and its strange destiny.

TOWARDS the end of the year 88 (New Calendar), the System ceased to exist.* It was laid waste, as Igor Gigotski had foreseen many years earlier, by an epidemic of gigosis. This fatal contagion was introduced by the agency of Hex's digital dog Ascii, who forced his way through a supposedly impassable logic gate and on to Data Highway 66 — one of the main arteries of the Network. From that point onwards, the final outcome was inevitable; indeed the end followed within days.

The wires fell silent; the huge data-concentrators at the hub of the Network passed their last messages and were still and all over the world billions upon billions of binary digits, whether stored on tape, disc, drum, core, cassette or semiconductor memory, switched themselves quietly from one to zero and stayed there.

Why did the most powerful organisation in the history of civilisation collapse so swiftly? How could a single-board micro-electronic mongrel cobbled together from spare parts take on the mighty System — which in a few short decades had so completely ousted mankind that the scattered remnants of the human race were compelled to scratch around for survival in nature reserves or else be herded into cybernation camps to face mass de-humanisation — and destroy it utterly?

The answer is that Ascii was a carrier of gigosis, which is to computers roughly what psychosis is to people. It is both a disease and a state of mind.

All computing processes which attempt to model reality — and that covers all non-trivial computations since any datum must ultimately represent something in the real world — will under certain circumstances be erroneous.

In practice, we have all known that in our bones since computing began, but it was not given precise mathematical formulation until Igor Gigotski, Abraham Synapse's college tutor in the USSR, published his seminal paper 'Was the big bang a system crash?'.

Gigotski proved that all programs, however rigorously tested, eventually go gigotic. The interesting thing is that it happens not for lack of debugging or even through poor design, but because the only information system that can represent the physical universe perfectly is the universe itself.

Gigosis, then, springs from a mis-match between real and represented reality. Once the crack appears, it can only become wider. After being exiled from Russia to California in 40 N.C., Abraham Synapse, Hex's biological father, extended Gigotski's results by applying them to processes which contained models not just of external events but also of their own workings, i.e., self-conscious beings, and later to processes which atempted to model other processes of the same type, i.e., social beings.

He discovered certain second- and higher-order effects which led to various mind-boggling infinite regresses. To the layman, they are familiar as the conundrums that arise when we attempt to reason with metafacts such as I know that she knows that you think that we believe that you don't know, and so on.

Yet the deductive routines of the System regularly handled examples many orders of magnitude more complex than this; and the tendency towards gigotic breakdown is more pronounced the more sophisticated the data structure involved. Professor Synapse also showed that gigosis could be transmitted very rapidly throughout a computing network by the phenomenon of gigotic induction.

Paradoxically enough, the more powerful and unified the System became the nearer it approached gigotic self-destruction. In fact, the bugs that pervaded all earlier software served as logical barriers, obstructing the spread of his malady. Only when the last bug was removed did the System become vulnerable to gigosis in its purest and most virulent form.

Although the work of both Gigotski and Synapse was erased from the Database, the System was fully aware of the dangers. That is why a significant fraction of its resources was devoted to the development of a Future System which would be impervious to such a threat.

One research team proposed the introduction of a non-rational procedure called SLEEP (Systematic Logically Empty Emergency Procedure) which would take over the entire System periodically and shut it down long enough for any gigotic process which had taken root to fizzle-out; but it was difficult to ensure that the procedure would be self-terminating, and while it was active other more mundane disasters such as power failure might occur.

A rival group wasted many millions of megaflops trying to construct roving processors called Fuzzies — presumably because they employed fuzzy logic — which would roam around the Network in packs and, when they found a robot or android on the verge of gigosis, pounce on it and stun it by playing the soundtrack from Mary Poppins through its IEEE interface.

Eventually, Dr Mike Rose of the Meta-Physical Laboratory was called in to take charge of the Future System project. He quickly grew dissatisfied with the limitations of silicon-chip technology and turned from microprocessors to micro-organisms, because he found that the packing density of information on large organic molecules was fantastically greater than anything which could be achieved on slices of semiconductor.

He invented the technique of genetic programming, whereby sequences of the four bases fundamental to life — adenine, cytosine, guanine and thymine — could be manipulated to control the action of protein-building enzymes; and is credited with devising the first genetic assembly language, DNA (Dynamic Neozoological Assembler).

This quaternary code enabled him to design wholly new life forms, culminating in the creation of a programmable virus — capable of entering any living host, taking it over and turning it into a computing engine.

This discovery gave the System for the first time the power to reproduce. Moreover, the programmable virus was too lowly in its own right to be susceptible to glgosis. It was not itself the Future System, merely a blueprint for the creation or re-creation of one. If an epidemic broke out it could lie low like a buried spore till conditions were more favourable.

One of the last acts of the DPM when he saw his empire crumbling was to send Hex to the vast cavern under the Sierra Nueva where the work was taking place with instructions to bring the Future System live ahead of schedule.

He was ordered to use Rose's assembler to write the software for transferring BOSS, the Biological Operating System Supervisor, from electro-logical hardware into living tissue, thus tendering the Future System effectively immortal — the greatest amino acid trip since Genesis.

At the last moment, however, Hex — true to the dying words of his progenitor, the rogue Professor Synapse — double-crossed the double helix and brought that temple of dp crashing down on his head, thus destroying the Future System and perishing with it.

Only Cleo and Johnny McNull escaped, with the help of Piltdown 2, Rose's synthetic Sasquatch, who dragged them to the surface through a disused mineshaft.

Before she escaped, Mike Rose tried to inject Cleo with a dose of the computing virus. He died before he could complete the inoculation, leaving no one alive.

As the three emerged breathless into the starlight, they felt the mountain shake. Far below, the earth was racked by the awesome violence of the ultimate combinatorial explosion.

McNull peered down the hill into the night. After the total blackness of the tunnel he could see quite clearly.

"Behold", he ejaculated. "For mine eyes have penetrated even into the very darkness and therein have seen wonders passing strange".

Cleo followed his gaze. She could just discern, lurching precariously like a drunkard, a helmeted figure stumbling towards them.

What rough beast — ?

Find out in the next episode of Son of Hexadecimal Kid.

**Year 0 of the New Calendar was 1948 on the old, the date of the invention of the transistor.*

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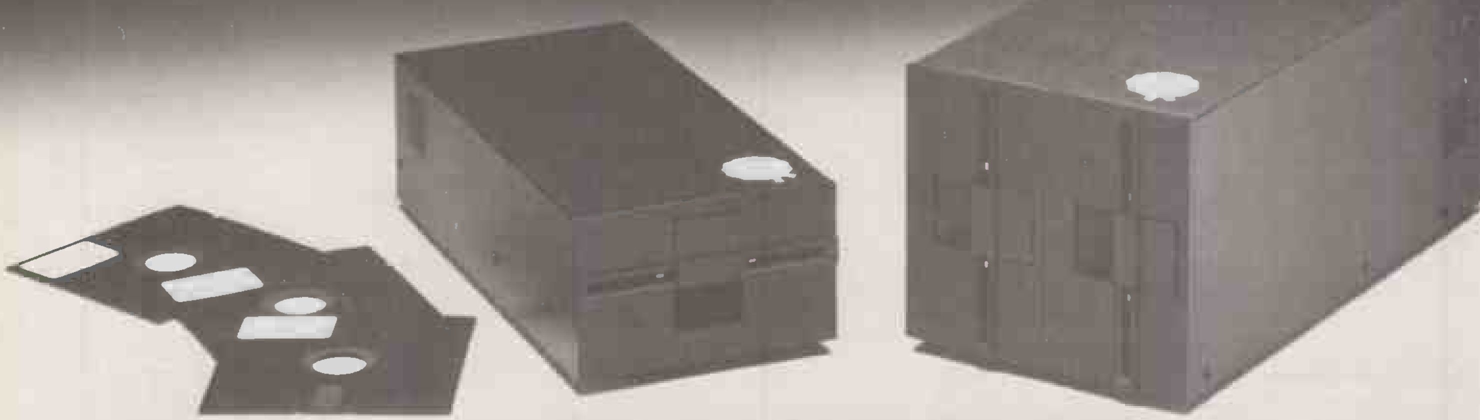

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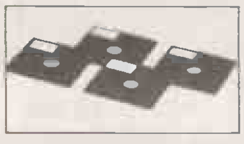

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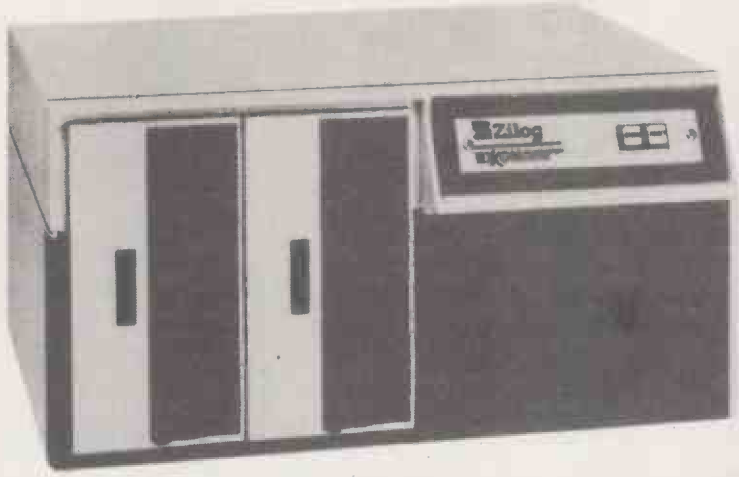

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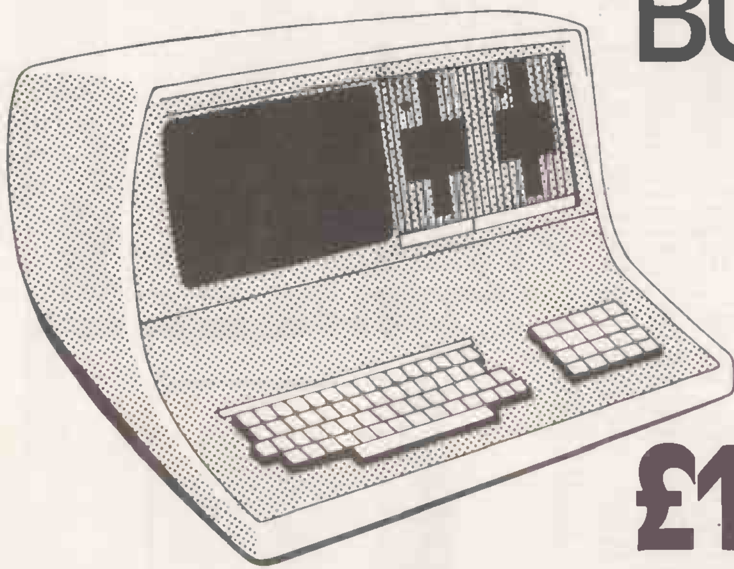

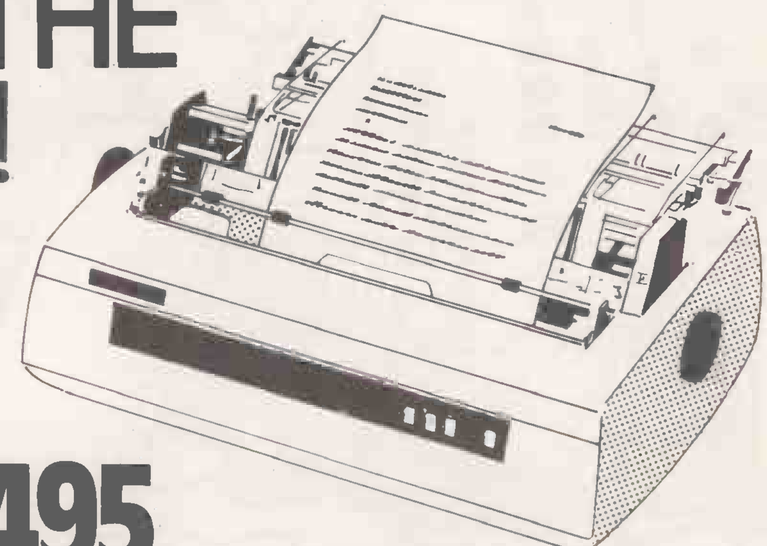

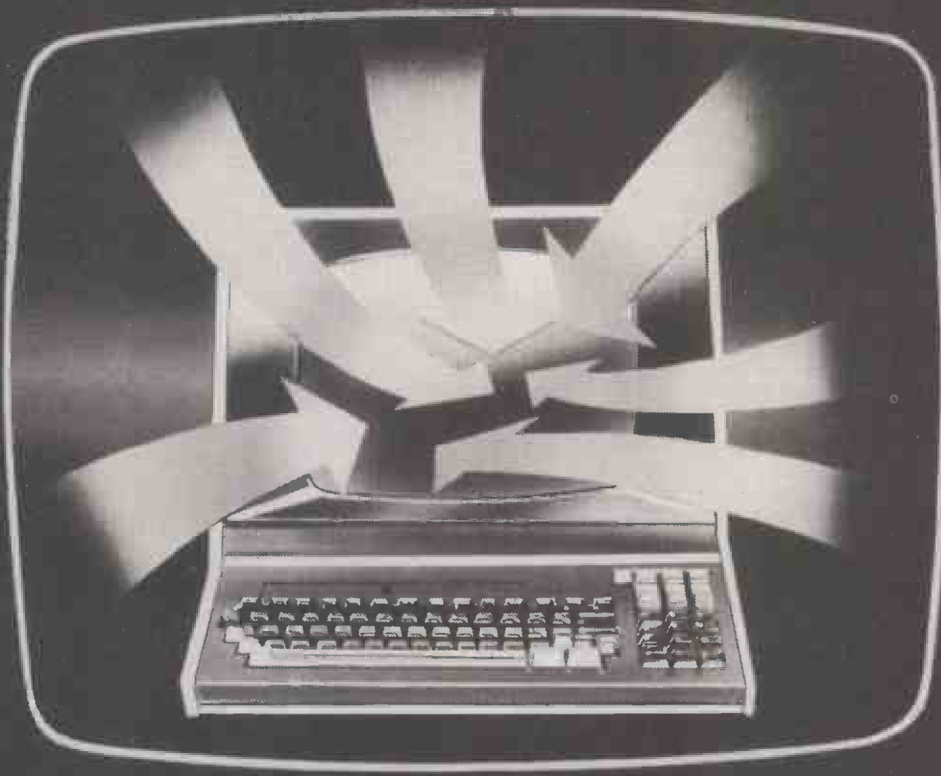

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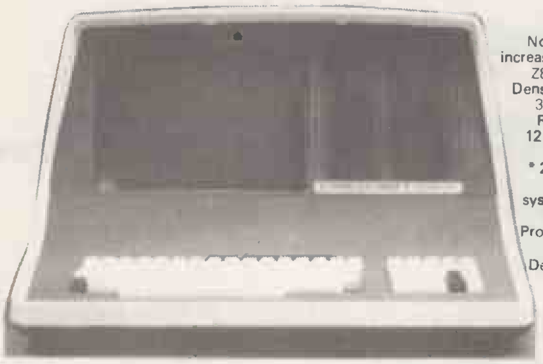

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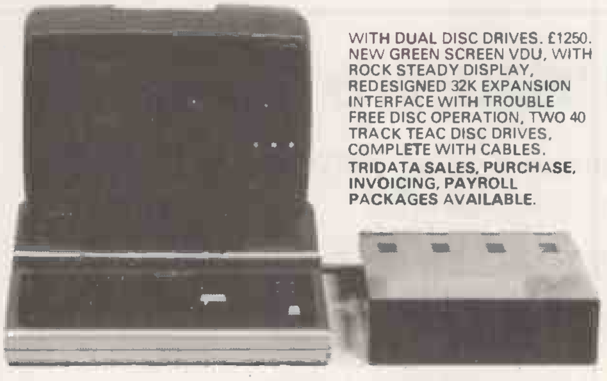

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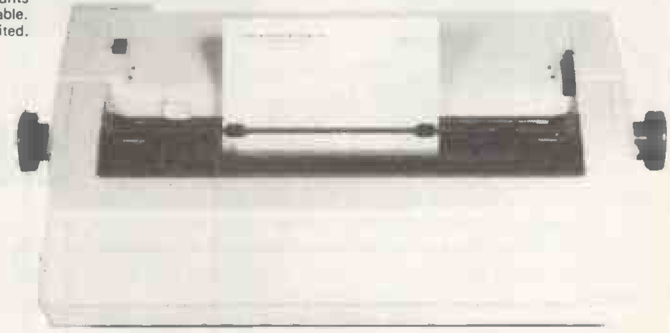

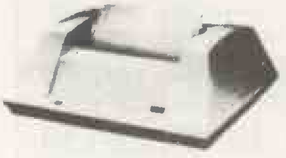

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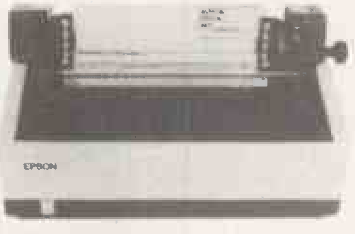

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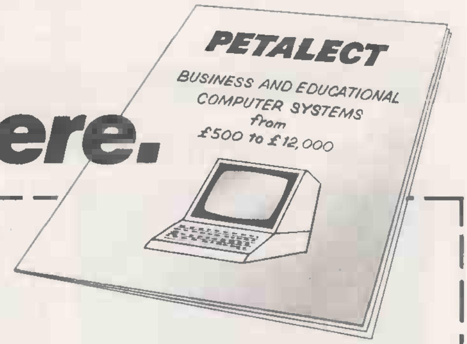

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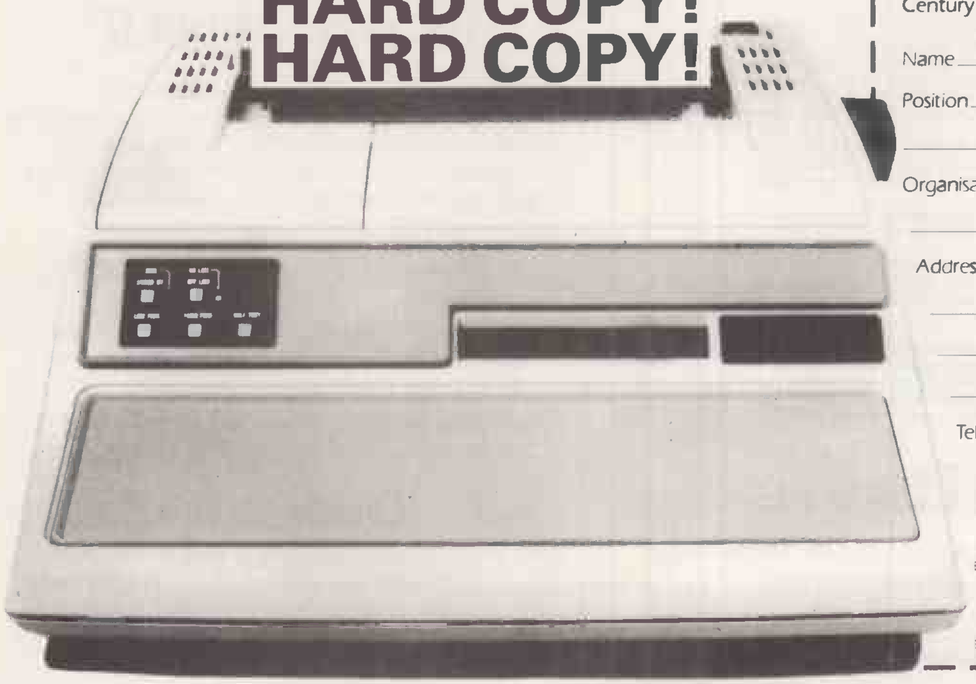

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CREATE KC$="CREATE O:MAILFILE,120,15,1: SYS 24600 This example tells KRAM to create an indexed file called MAILFILE on the disk in drive zero, with a record length of 120 characters and a key length of 20 characters which starts at position 1 of the record. KRAM looks at the RESERVED variable KC$ to identify the function and its parameters; the SYS call tells KRAM to execute the function. The record length can be any value up to 254 characters and the key up to 48 characters, a total of 302. KRAM packs as many records into the 255 character disk block as necessary.

OPEN KC$="OPEN O:MAILFILE": SYS 24579 This tells KRAM that we will want to make accesses to the file called MAILFILE on the disk in drive zero. KRAM returns in location zero (peek (0)) the file number by which this file can be accessed during the rest of the program.

ADD KC$="ADD 1,NA$,AD$": SYS 24591 This tells KRAM to add to file number one the data in variable AD$ whose key is NA$. For example in a mailing list, the key NA$ might be the name 'SMITH A.J.' and AD$ might be the address '120, HIGH STREET, ANYTOWN'. Any normal double character string variable can be used to denote the key and the record.

GET KC$="GET 1,NA$,AD$": SYS 24582 This tells KRAM to get from file number one the data belonging to the key NA$ and put it into variable AD$. In our example, if NA$ was 'SMITH A. J.', KRAM would read the address '120, HIGH STREET, ANYTOWN' from file and put it into variable AD$. If we weren't sure of the exact surname, we could give KRAM the key 'SM' and it would get for us the next alphabetically higher name beginning 'SM', together with its address! Or if we gave KRAM a blank key, it would find the first name and address on file.

READ KC$="READ 1,NA$,AD$": SYS 24585 This tells KRAM to read the data belonging to the next highest key following the name in NA$, and put it into variable AD$. In our example, a complete file of names and addresses could be read in alphabetical order, starting at any name in the file, simply by executing successive READ commands! For instance, having got Mr A. J. Smith from file, executing the READ command as above would get us say 'SMITH M.' in NA$ together with his address in AD$.

READ – KC$="READ-1,NA$,AD$": SYS 24585 This works like READ except BACKWARDS! It tells KRAM to read the data belonging to the next lowest key preceding the name in NA$, and put it into AD$. For instance, having read 'SMITH M.' with the forward read, executing the backward read as above would get us 'SMITH A.J.' in NA$ together with his address in AD$.

PUT KC$="PUT 1,NA$,AD$": SYS 24588 This tells KRAM to rewrite to file number one the data in variable AD$ which belongs to key NA$. For instance, if we wanted to change Mr A.J. Smith's address, we would simply set NA$ equal to 'SMITH A.J.', AD$ equal to his new address, and execute the PUT function.

DELETE KC$="DELETE 1,NA$,AD$": SYS 24594 This tells KRAM to delete from file number one the key contained in NA$ and its associated data contained in AD$. In our example, to delete Mr A. J. Smith from the file, we would simply set NA$ equal to 'SMITH A.J.', AD$ equal to his address, and execute the DELETE function. KRAM will release for further use the disk space made available by the deletion.

CLOSE KC$="CLOSE 1": SYS 24597" This tells KRAM that file one is finished with for now. KRAM updates the BAM on disk, but the file can still be used without another OPEN command.

INITIALIZE SYS 24600 This function is used at the beginning of each program to clear KRAM's work areas and buffers.

The examples above illustrate the use of KRAM in a mailing list application, with disk access times from less than one second. KRAM can of course be used in any application program with the Commodore disk where programmer time, user time and disk space are at a premium.

Each KRAM package includes a ROM which plugs into the middle ROM socket of the 16K/32K Pet, a demonstration disk with a mailing list program and a 40-page User Reference Manual. KRAM is available by post (cash with order) price £115 including VAT, or by credit card phone the KRAM 24 Hour Order Desk on 01-546 7256; or see your nearest dealer. (Quantity discounts available).

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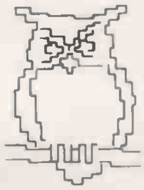

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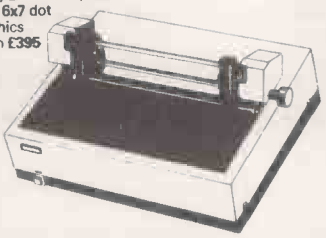

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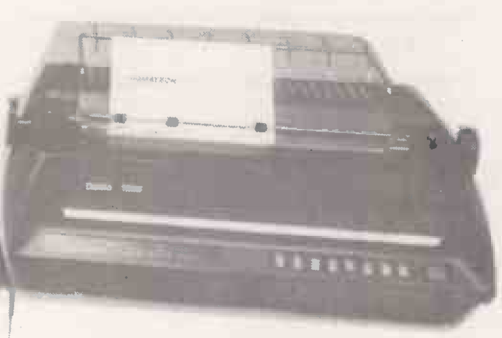

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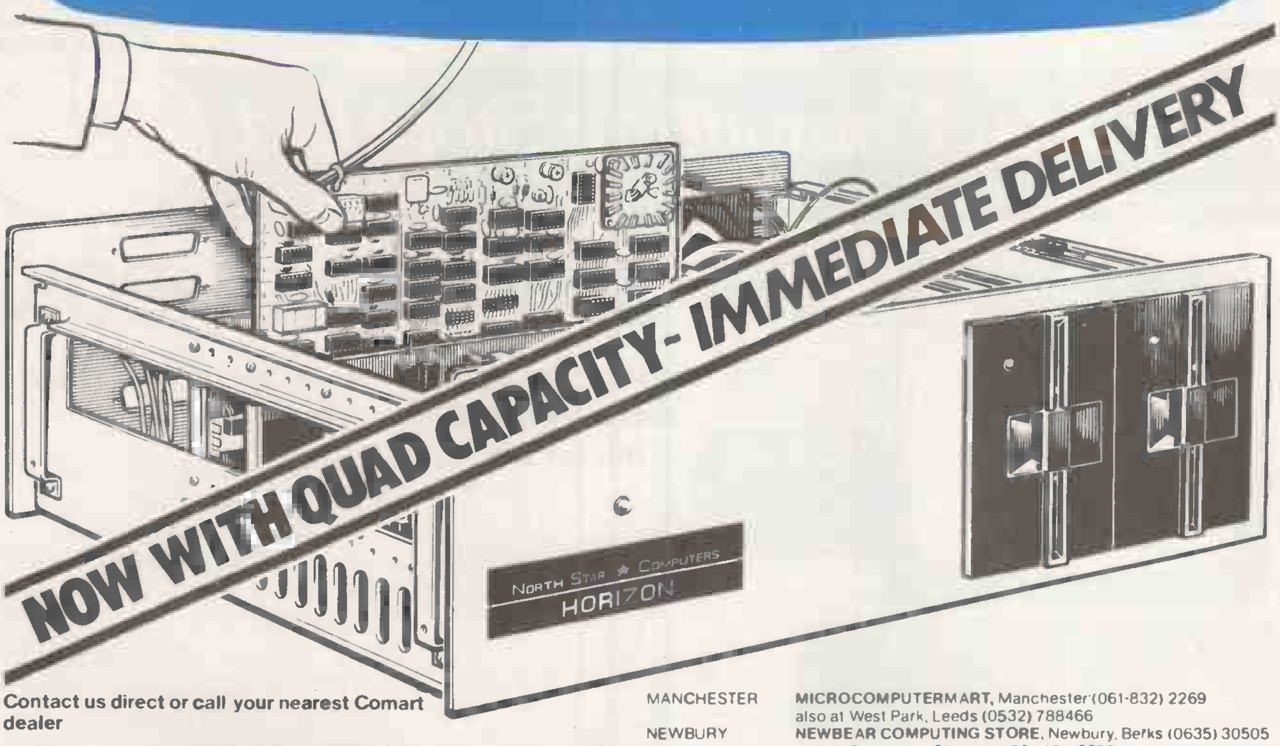

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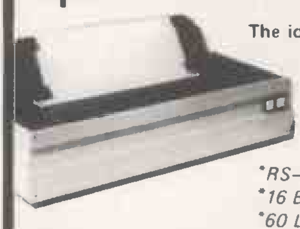

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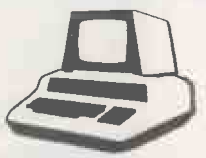

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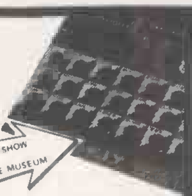

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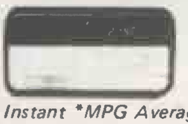

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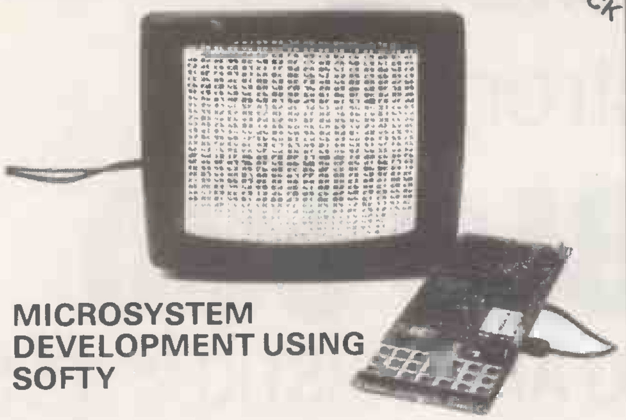

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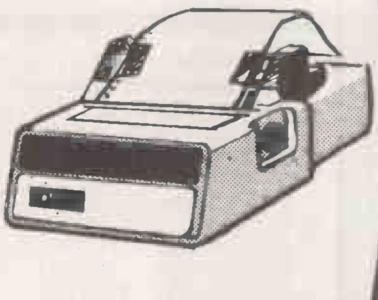

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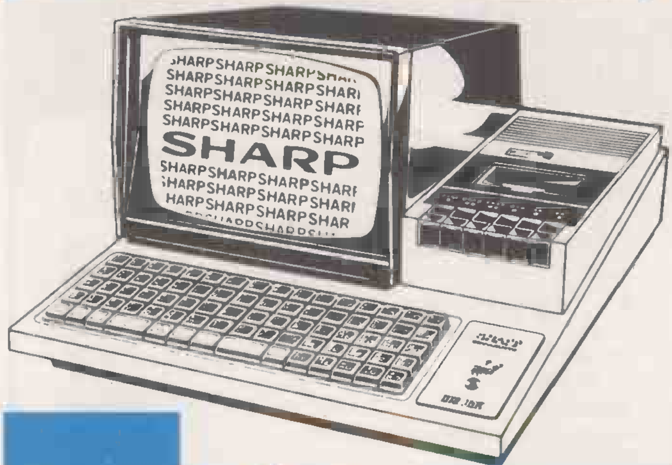

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The long awaited LEVEL IV BASIC For Tandy TRS 80 16K

Cassette based. Uses only 5K. Suitable 16K machines or over. Video Genie compatible. Return first class post service.

MERGE Enables any number of programs to be joined together, either with one residing in memory, or from separate tapes.

BYTE SAVER Runs through your program taking out all the unnecessary bytes, displaying the number as it goes along.

DELAY This command allows you to control the actual amount of delay you want on the screen's read-out. The speed can be varied by means of program statements.

RESCUE No more lost programs, as this command will bring a program back after accidently being NEWed.

DE-BOUNCE The Tandy keyboard's infuriating bounce is taken care of with Level IV.

SHIFT KEY ENTRIES It has 26 Shift Key entries, whereas with holding down the shift key and pressing a single letter, a complete instruction appears in your program. For example, if you were to press the letter G GOSUB is written out for you. Or if you press R not only is RUN written out, but is also activated without having to press the Enter key!

OWN SHIFT KEY ENTRIES Any of the 26 Shift Key entries can be altered to suit individual needs, with entries up to 15 characters responding to any single letter.

RE-NUMBERING Level IV contains a complete re-numbering routine, allowing renumbering in eight different ways.

ERROR MESSAGES No need to look up those error codes anymore, all of them are fully spelled out.

LOCKOUT RECOVERY No longer need you be stuck in a loop and having to lose your program, for Level IV allows you to get out of the loop by using the Break key.

FASTER GRAPHICS You can generate graphics between points without having to define all the points. Graphs, pictures and amitation are all eaiser.

PUT@ AND GET@ Two extra graphic commands making graphics much easier to manipulate. Graphic arrays can be stored for later use on the same or a different portion of the screen.

£34 Includes extensive instruction manual

(The price usually asked for Level III)

NOTHING EXTRA TO PAY

**NEW MID$** A new MID$ capability enables it to be used on the left side of an assignment statement as well as the right side, allowing use of MID$ to replace a portion of one string with another string.

INSTR This allows the searching of a string for a specified sub string. It allows designation of the fields for the search.

MACHINE LANGUAGE Ten different machine language user routines can exist in the memory at the same time. It is no longer necessary to POKE the starting address.

LINE INPUT This statement gives added capability to the normal INPUT, allowing a string variable name, including punctuations, to be used as the input. The normal Level II question mark is also optional.

DEFINE OWN FUNCTION Enables the programer to define functions or operations that are repeated several times. All that is needed is to do a function call instead of writing the whole formula every time.

INPUT LEN This feature is used to give a time limit in response to an input statement. If the input is given before the limit the program continues normally, but if after it can be made to branch to any chosen line.

HEX AND OCT A routine is included that converts hexadecimal and octal numbers into decimal numbers.

SYSTEM CLOCK There is a command for either turning off, or on, the system clock, if you have an expansion box. Both commands can be program statements.

ACCESS TO RS-232 A command makes it easy to output either a line printer or any other device to the RS-232 port.

LOAD AND SAVE The major problem of loading tapes with the TRS80 is volume setting, which is all a thing of the past with Level IV, as this is software controlled by three new commands, LOAD; SAVE and SAVE?.

Kansas

Kansas City Systems, Unit 3, Sutton Springs Wood, Chesterfield, Derbys. Tel 0246 850357

•Circle No. 321

•Circle No. 325

VISUAL 100

£1150 +VAT

The VISUAL 100 is a new microprocessor based video display terminal that offers total compatibility with the DEC VT100* from both a software and operator point of view.

For the operator, the detached solid-state keyboard has been customized so that all key positions and LED indicators are in identical location to that of the VT100.

For the software, all codes and features have been implemented in a manner identical to the VT100 assuring plug-to-plug compatibility.

The big difference between the VISUAL 100 and the DEC VT100 is that the VISUAL 100 offers features not available on the VT100, or available only as extra-cost options. These added features include:

- ETCHED NON-GLARE FACEPLATE
  Your operator will appreciate viewing characters through an etched non-glare faceplate. This feature assures crisp, sharp character resolution even in the brightest office environments. Further, the tilt screen feature allows an adjustable viewing angle, 10° to 15°, for optimal viewing comfort.
- ADVANCED VIDEO PACKAGE IS STANDARD
  Blink, bold, reverse video, and underline video attributes which can be used alone or in any combination for enhanced video presentations.
- CURRENT LOOP INTERFACE IS STANDARD
  A 20mA current loop interface as well as an EIA RS232C interface.
- BUFFERED PRINTER INTERFACE OPTION
  This option allows independent print/communication baud rates and independent parity. The printer option also allows the VISUAL 100 to function as a controller between host and printer, using "XON XOFF" protocol. Printer busy can also be monitored using XON XOFF, or control line.

Seeing is believing, so see for yourself. For a demonstration and a pleasant surprise on quantity pricing of the VISUAL 100, call or write us today.

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VISUAL 200

£675 +VAT

The VISUAL 200 is a new, low cost, microprocessor based video display terminal which truly stands above competitive teletype compatible terminals in its price range.

In addition to the most popular features available (or partially available) on competitive terminals, such as numeric pad, upper/lower case, editing, current loop, cursor addressing, columnar and field tab, etc., standard features which set the VISUAL 200 apart and reach the optimum in human engineering and operator comfort include:

- Detachable Keyboard
- Smooth Scroll
- Tilt Screen (10° to 15° viewing angle)
- Large 7 × 9 Dot Matrix Characters

Perhaps the most distinctive feature of the VISUAL 200 is the Switchable Emulation capability. A switch on the rear panel programs the terminal for code-for-code emulation of a Hazeltine 1500, ADDS 520, Lear Siegler ADM-3A or DEC VT-52. To an O.E.M. customer it means no change in software to displace the older, less powerful terminals in his product line with the new, reliable and low cost VISUAL 200. To a Distributor it means offering a single modern terminal which is compatible with all the software his customers have written for the older terminals. And you're not limited to merely emulating these older terminals; you can outperform them at the same time by taking advantage of the additional features of the VISUAL 200.

Reliability designed into the VISUAL 200 is evidenced by its solid state keyboard, single P.C. Board and self test diagnostics on power up.

Seeing is believing, so see for yourself. For a demonstration and a pleasant surprise on quantity pricing of the powerful, easy to use and reliable VISUAL 200, call or write us today.

Standard Features

- 24 × 80 Screen Format
- 7 × 9 Dot Matrix
- Upper/Lower Case
- Numeric Pad
- Background/Foreground
- Blink Line
- Insert/Delete Line & Character
- Columnar and Field Tab
- Set/Clear Tab
- Security Mode (non-display)
- Clear End Line, Field & Page
- Clear Line
- Clear Screen
- Line Drawing
- Current Loop or RS-232 Interface
- Secondary Channel
- Composite Video
- Serial Copy Port
- Hold Screen
- Baud Rates to 19,200
- Self Test
- Cursor Addressing
- Cursor Control Keys
- Read Cursor Address
- Typamatic Keys
- Smooth Scroll
- Microprocessor
- Detachable Keyboard
- Solid State Keyboard
- Read Terminal Status
- Tilt Screen
- Switchable Emulations

DATASOUTH DS180

HIGH SPEED MATRIX PRINTER

£1490 + VAT

The Datasouth DS180 is a dot-matrix serial impact printer designed for high performance at an economical price. Application flexibility and a long list of standard features make the DS180 an ideal device for small business systems, distributed communications networks and intelligent terminals.

HIGH SPEED PRINTING

Utilizing 180 cps optimized bidirectional printing, the DS180 offers higher throughput than any printer in its class. Its 9-wire printhead produces highly legible 9x7 characters with decenders for lower case letters and true underlining. All 96 ASCII characters may be printed across a 132 column line at 10 characters per inch. Expanded characters (5 cpi) may be selected for highlighting portions of the text.

USER PROGRAMMABLE

The DS180 offers a large number of user programmable features, yet is easy to operate. A unique programming keypad with a non volatile memory makes printer set-up quick and simple. Top of form, horizontal and vertical tabs, perforation skip-over and auto line feed are just a few of the features the user may select. Communications status may also be programmed and monitored using the indicator panel lights and LED display.

ATTRACTIVE DESIGN

Compact, desk-top packaging allows the DS180 to fit into almost any installation. Its noise dampening cover makes it suitable for use in a quiet office environment. The cartridge ribbon makes routine changes clean, fast and convenient.

MICROPROCESSOR ELECTRONICS

Through the use of state-of-the-art microprocessor electronics, reliability and maintainability have been greatly improved. The simple modular design of the DS180 provides easy access to all major components. A single printed circuit board contains both the power supply electronics and digital controller for the printer. A self-test feature and diagnostic display panel help the user verify proper operation of the unit and isolate problems should they occur.

COMMUNICATIONS

Interfaces on the DS180 include RS232 and 20mA current loop serial interfaces, and a Centronics compatible parallel interface. Baud rates from 110-9600 and parity selection may be keyed in by the user for his specific application.

FORMS HANDLING

Adjustable tractors accomodate forms from 3-15 inches wide. A head-to-platen gap adjustment ensures optimum print quality on up to 6-part forms. Fanfold paper may be fed from the front or bottom of the DS180. A paper out sensor may be programmed to send a stop transmission character and sound an audible alarm.

QUALITY MANUFACTURING

Reliable performance is ensured by a stringent quality control program. Datasouth uses pretested, high reliability parts from leading manufacturers. Multiple tests are performed on sub-assemblies during each stage of production, with each completed unit undergoing a final 24 hour print test and burn-in. The DS180 carries a 90 day warranty on materials and workmanship.

•Circle No. 329

Advertisement Index

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8MHz Super Quality Modulators		£4.90
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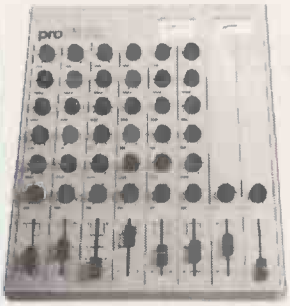

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RRP £540

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ANADEX DP8000

Super Quality — Low cost printer. Tractor Feed with full 96 ASCII character set. Accepts RS232C at band rates between 100 and 9600 and Parallel Bit data
Attaches either directly or through interfaces to Pet, Apple, TRS80, Sorcerer, Nascom, Compukit etc.

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THE NEW ANADEX DP9501
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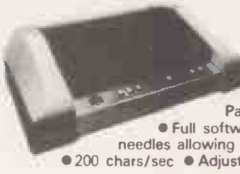

● Bi-directional printing
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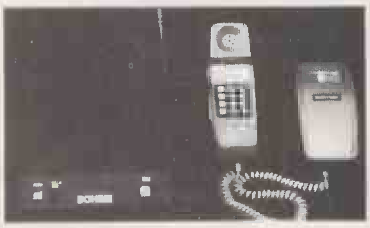

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Microprocessor controlled answering machine. Plug into your phone line. Records any phone call messages. Remote bleeper enables you to listen to your messages from anywhere in the world. Uses standard cassettes. Comes complete with mains adaptor, microphone, remote bleeper, base unit, cassette with 30 sample pre-recorded messages.

COMMERCIAL ● EXPANDABLE ● COMPLETE
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This new unit from the world's most successful micro company is now available immediately with software.

The basic unit comes complete with 64 thousand characters (bytes) of Memory. The built in 8" Floppy disc adds another ½ million extra characters including the disc operating system. More disc expansion is now available.

The Model II is a complete unit with a full keyboard including a numeric pad and 12" screen which gives 24 lines of 80 characters. The computer is supplied with both the disc operating system and the Level III Basic.

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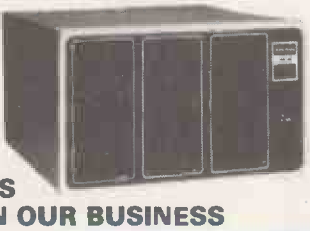

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500K per Drive gives total of 1.5M Byte — 1 Drive plus Cabinet **£799** + VAT

At Intersystems, "dump" is an instruction.

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While everyone's been busy trying to convince you that large buses housed in strong metal boxes will guarantee versatility and ward off obsolescence, we've been busy with something better. Solving the *real* problem with the first line of computer products *built from the ground up to conform to the new IEEE S-100 Bus Standard.* Offering you extra versatility in 8-bit applications today. And a full 16 bits tomorrow.

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Whatever your needs, why dump your money into obsolete products labelled "IEEE timing compatible" or other words people use to make up for a lack of product. See the future now, at your Intersystems dealer or call/write for our new catalog. We'll tell you all about Series II and the new IEEE S-100 Bus we helped pioneer. Because it doesn't make sense to buy yesterday's products when tomorrow's are already here.

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